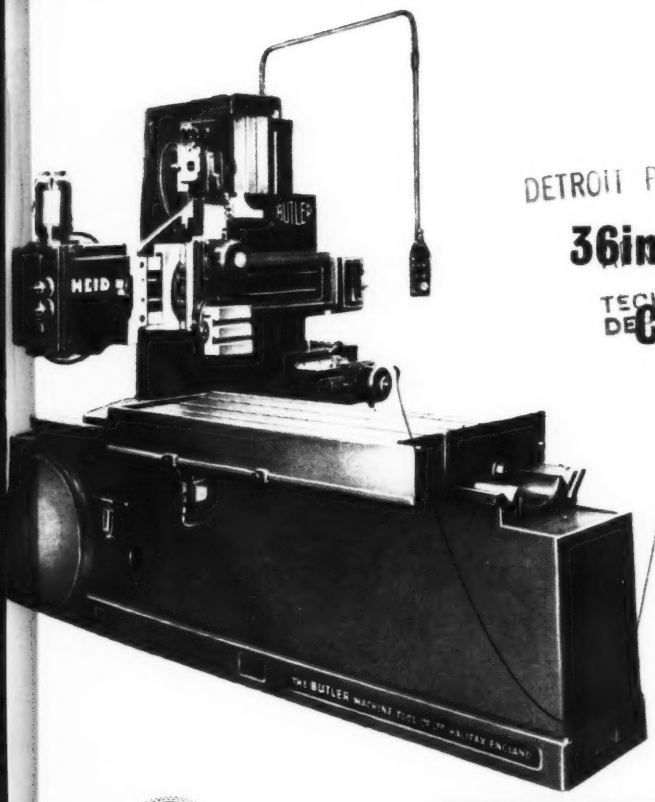
MACHINERY

MARCH 29, 1961 ONE SHILLING & THREEPENCE

Butler



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BUTLER MACHINE TOOL Co LTD

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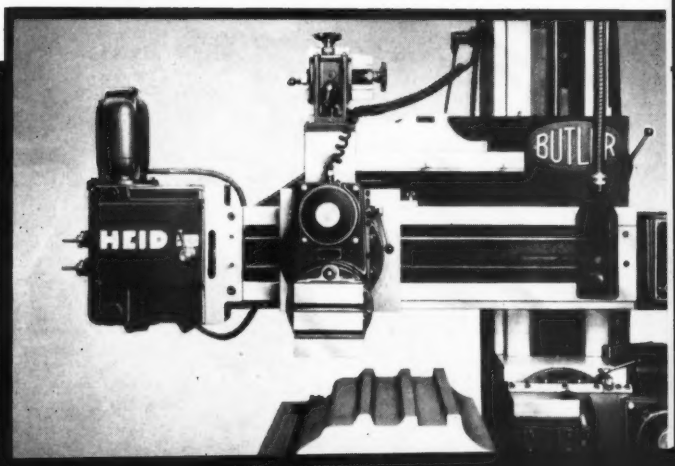
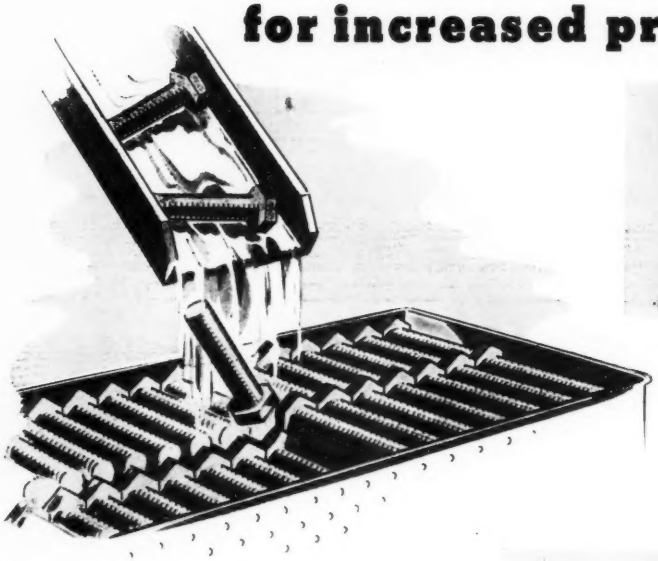
PLANING, SHAPING & SLOTTING MACHINES



MILLS LEDLOY

BRIGHT STEEL BARS

for increased production



·820" a/f · LEDLOY E.N.I.A.

1·75" dia. LEDLOY·40%c

MILLS LEDLOY bright steel bars contain a small percentage of lead, giving greatly improved machining properties to all standard qualities, Freecutting, Casehardening, Carbon, Heat-Treated Carbon and Alloy steels without impairing their physical properties in any way.
These can be supplied to Admiralty, Air Ministry and many other specifications.

MILLS LEDLOY steels have been known to give an increase in production of up to 100%.

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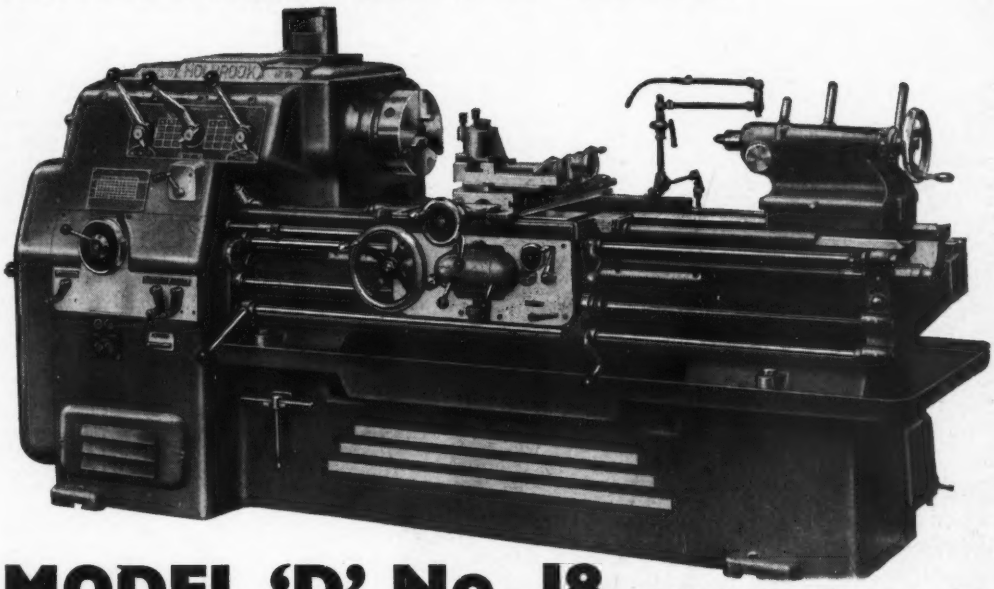
..... 18 SPINDLE SPEEDS 15 TO 1000 R.P.M.



MODEL 'D' No. 18 NOMINAL CAPACITY 18" × 42"

PRECISION LATHES WITH..

HARDENED BEDWAYS

CAM-LOCK SPINDLE NOSE
ENCLOSED GEARBOX AND APRON
BUILT-IN TAPERING EQUIPMENT
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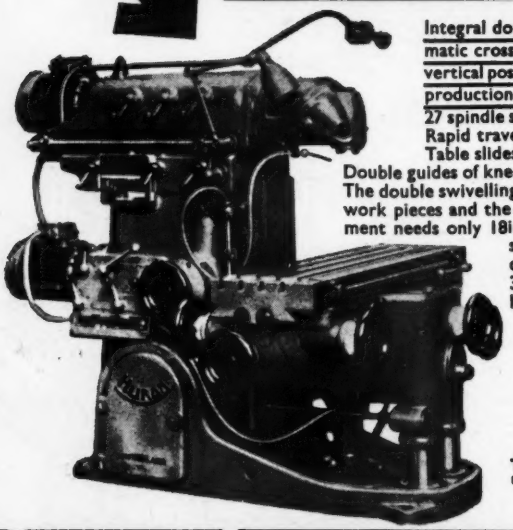
A

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from ⅛in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39½in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

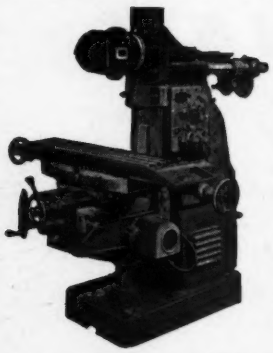
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15½in.	43½in.	27½in.	19½in.
KU5	64½in. × 15½in.	51½in.	27½in.	19½in.
KU6	78½in. × 16½in.	59in.	27½in.	19½in.
KU55	64½in. × 26in.	51½in.	39½in.	18½in.
L83	157in. × 59in.	118in.	39½in.	59in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61

FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18½in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ½-23½in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9½in.	27½in.	9½in.	15½in.
61	47½in. × 10½in.	30½in.	9½in.	15½in.
59	51½in. × 11½in.	34½in.	11½in.	21½in.
54	67in. × 14½in.	43½in.	14½in.	20½in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

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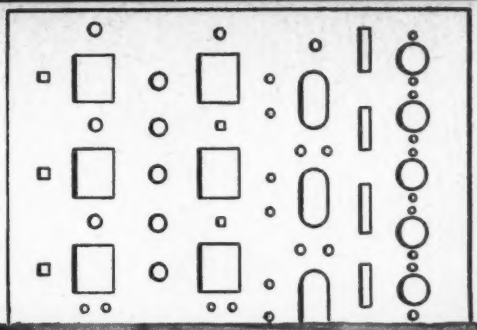
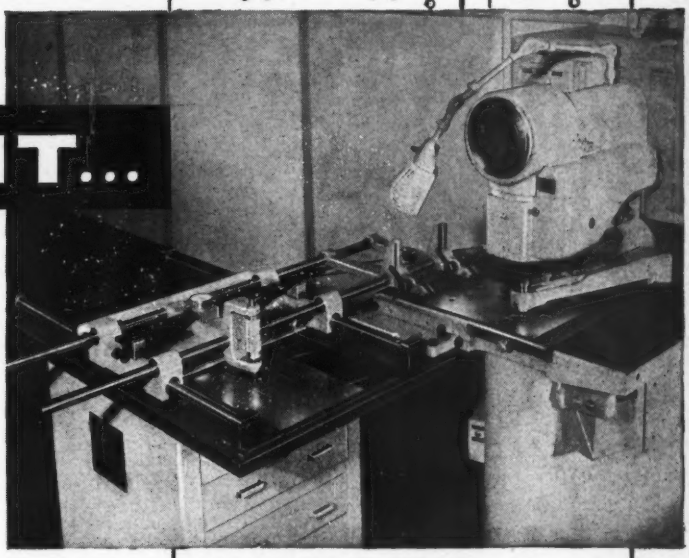


WALES

STRIPPIT...



sheet metal
FABRICATOR
and
POSITIVE
DUPLICATOR

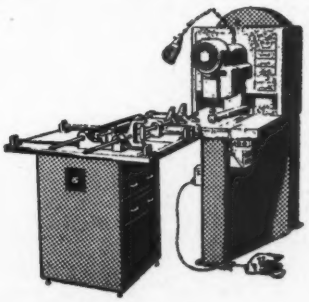
Ideal for short or pilot runs — model shop and experimental work. The patented punch, stripper and die button assemblies can be changed from one size or shape to another in less than 20 secs.

The POSITIVE DUPLICATOR converts the FABRICATOR to a medium run production machine for precision sheet metal work or for cold-punching printed circuit boards without heating, die-making, drilling or deburring.

Write for illustrated literature on full STRIPPIT range of accessories and tooling.

SPECIFICATION

STROKE — $\frac{3}{8}$"
SHUT HEIGHT — $5\frac{11}{32}$" stroke down (non-adjustable)
MOTOR — 1 h.p. 220/440v. 3 phase. 50 cycle.
STROKES PER MINUTE — 165 for single punching or nibbling
THROAT DEPTH OF PRESS — 15"
TABLE WORKING SURFACE — 30" wide x 20" deep.



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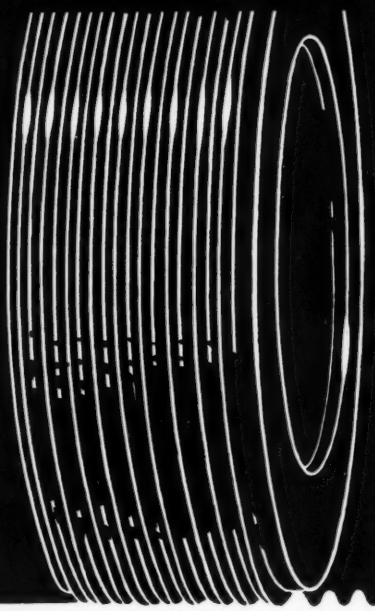

— fit your thread-rolling heads

Herbert Ground-Thread Rolls for thread rolling die-heads have achieved a high reputation for precision and durability combined with high rates of production.

with HERBERT ground-thread rolls

These rolls are made in the same works and under the same conditions as Coventry Die-heads and Dies and Herbert-Ground Thread Taps which are world-renowned for quality and accuracy.

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Full details and prices are obtainable from our Threading Dept., Head Works.

We also manufacture circular and flat thread-rolling Dies to suit all leading makes of machines.

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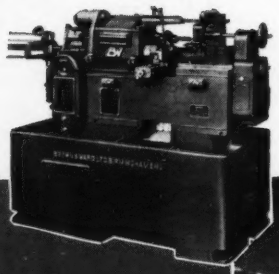
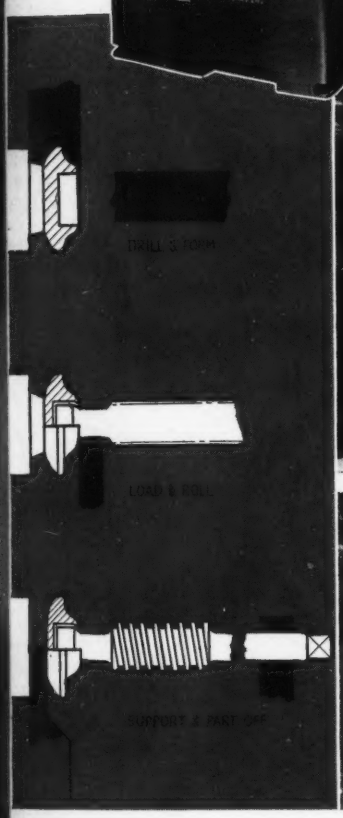
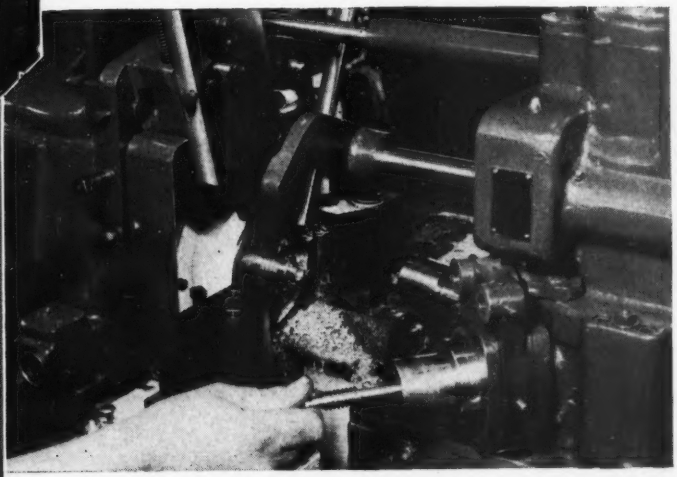
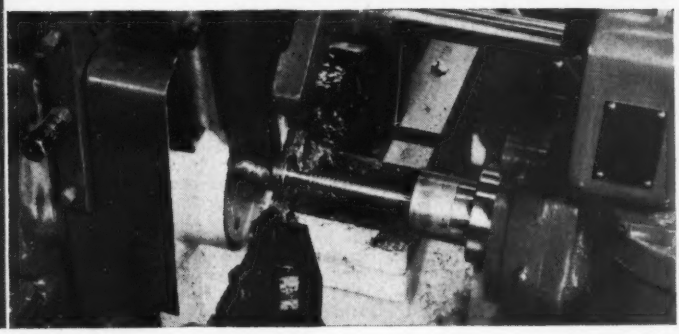


simplicity of repetition machining on —







A Brown & Ward 1¼in. 4-Operation Bar Automatic produces brass clack valves at the rate of 3.6 components per minute.

After the forming and drilling, the machined stem is loaded into the loading head on the turret and inserted in the valve body.

The wall of the valve head is peened over the edge of the stem, prior to parting-off.

BROWN & WARD
single-spindle BAR AUTOMATICS

Uses simple *standard* cams and tools.

Wide range of attachments increases versatility.

Competitive to six-station machines relative to low capital outlay.

Six sizes, three types, for work up to 1½" dia. x 4½" long.

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Using Almco Supersheen barrel-finishing equipment and materials, *unskilled* operators can turn out *precision* DEBURRING, DESCALING, BURNISHING, POLISHING, etc., with practically no rejects, with savings of up to 87%, at ten times the speed of hand-finishing.

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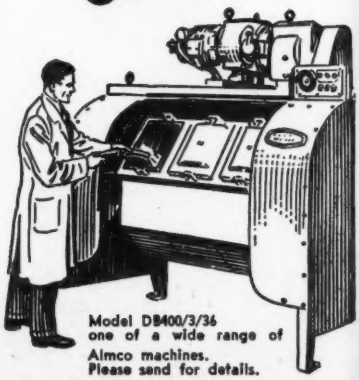

Model DB400/3/36 one of a wide range of Almco machines. Please send for details.

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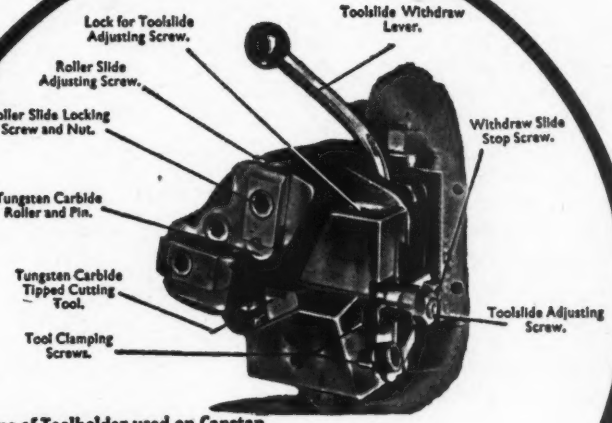
For Heavy Cuts at High Speeds

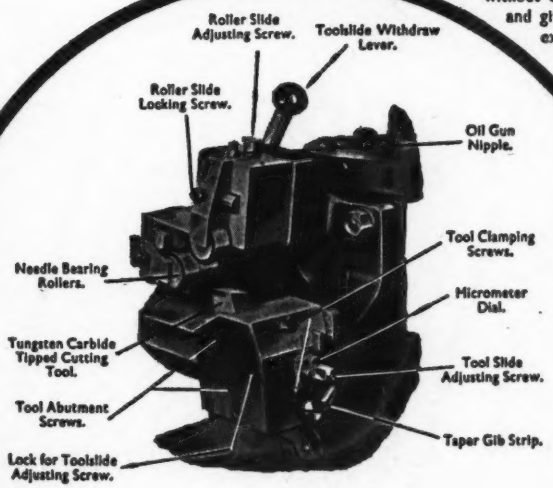
Ward

Tangential Roller Turning Toolholders


Lock for Toolslide Adjusting Screw.
Toolslide Withdraw Lever.
Roller Slide Adjusting Screw.
Roller Slide Locking Screw and Nut.
Withdraw Slide Stop Screw.
Tungsten Carbide Roller and Pin.
Tungsten Carbide Tipped Cutting Tool.
Toolslide Adjusting Screw.
Tool Clamping Screws.

Type of Toolholder used on Capstan Lathes

Toolholders for capstan lathes have long-life tungsten-carbide rollers and pins allowing maximum speeds to be used without danger of seizure and giving the work an excellent burnished finish.



Type of Toolholder for Turret Lathes

Toolholders for turret lathes have rollers mounted on anti-friction needle bearings and the roller slides have provision for oil gun lubrication.

Constructed for use with tungsten-carbide tools, these holders present the tool tangentially to the work in a quickly set robust slide having micrometer adjustment. Tool relief on return stroke obviates marking work.

MOST SIZES FROM STOCK OR EARLY DELIVERY

DESCRIPTIVE LEAFLETS ON APPLICATION

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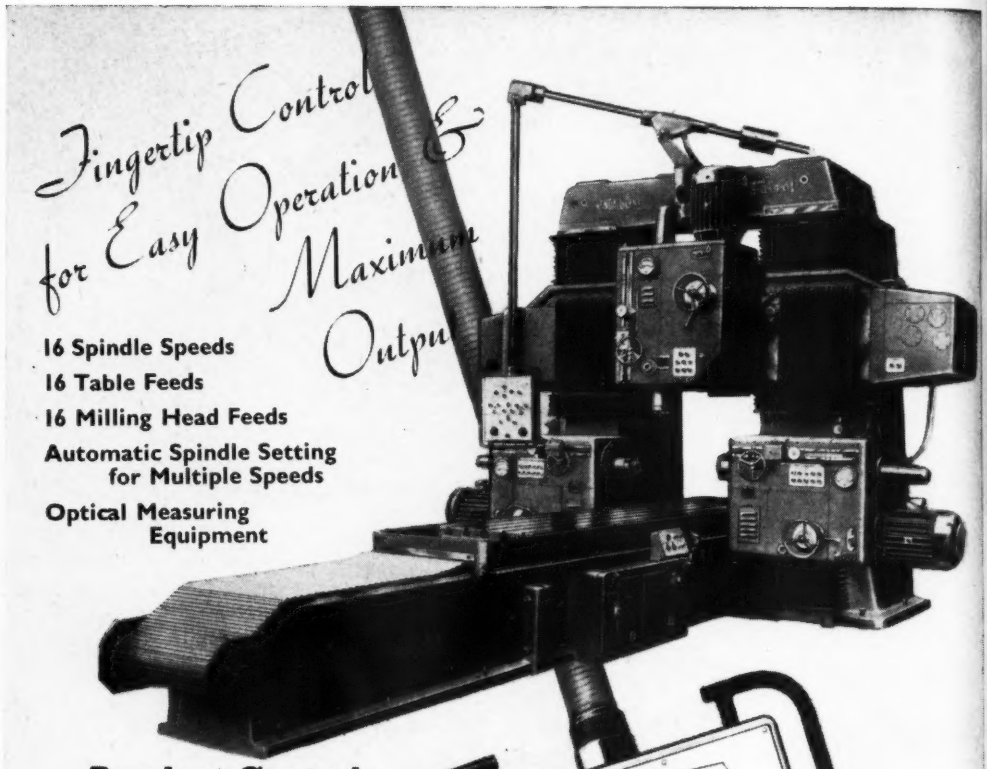
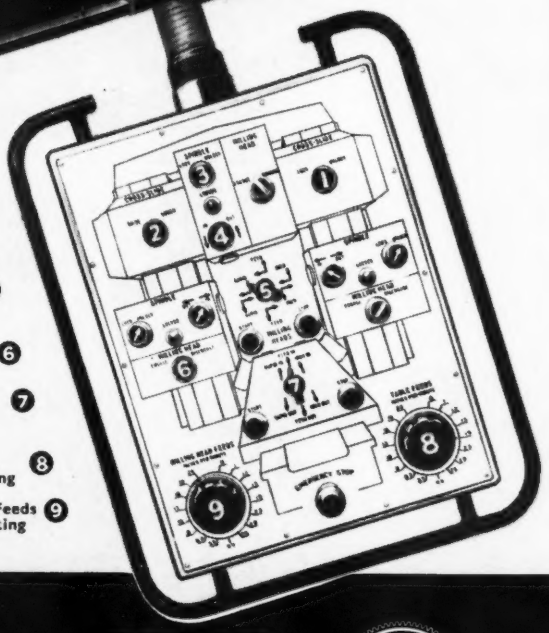
Fingertip Control for Easy Operation & Maximum Output

16 Spindle Speeds
16 Table Feeds
16 Milling Head Feeds
Automatic Spindle Setting for Multiple Speeds
Optical Measuring Equipment



Pendant Controls



Cross-slide : Lock or Unlock 1
Cross-slide : Raise or Lower 2
Spindle : Lock or Unlock 3
Spindle Traverse : Down or Up 4
Milling Heads Traverse : Select Direction and whether Rapid Feed or Inch 5
Milling Head : Unclamp & Start or Stop & Clamp 6
Selector for Table Traverse : Select direction and whether Rapid, Feed or Inch 7
Selector for Table Feed : Adjustable even during cutting 8
Selector for Milling Head Feeds Adjustable even during cutting 9

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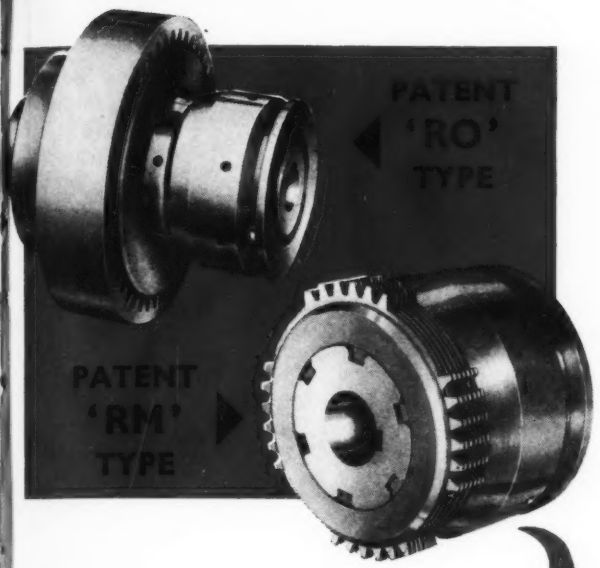
A Crofts clutch does so much at a touch...



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ONLY WITH CROFTS PATENT ROLLER OPERATED DISC CLUTCHES DO *YOU* GET ALL THESE DISTINCTIVE ADVANTAGES

- ★ **roller-operated; no toggles or links.**
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- ★ **simple, one-point adjustment.**
- ★ **drive in either direction of rotation.**
- ★ **availability ex-stock, with or without adapter rims.**
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- ★ **transmission from fractional to over 500 h.p.**

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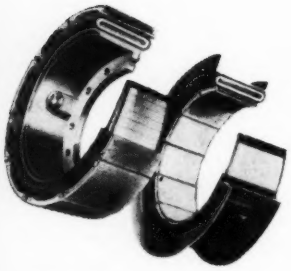

AIRFLEX CLUTCH
up to 3,440 h.p. at finger-tip control; air-actuated.

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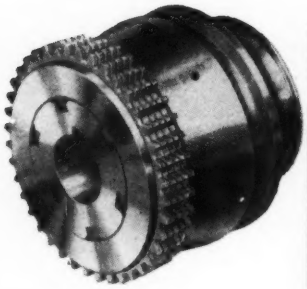

BOM-L MULTIDISC
from fractional to 15 h.p. at 100 r.p.m. Never needs adjusting.

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RIM CLUTCH
up to 180 h.p. at 100 r.p.m.

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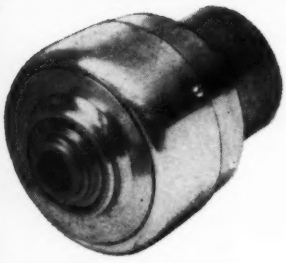

CENTRIFUGAL MULTIDISC CLUTCH
eight sizes; up to 215 h.p. at 1,300 r.p.m.

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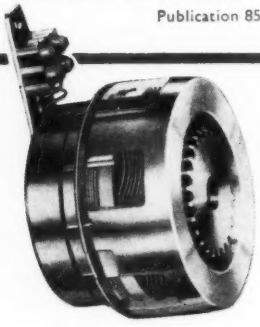

PATENT STATIONARY FIELD MAGNETIC CLUTCH
up to 50 h.p. at 100 r.p.m. operating at 24 v. D.C. (other voltages to order).

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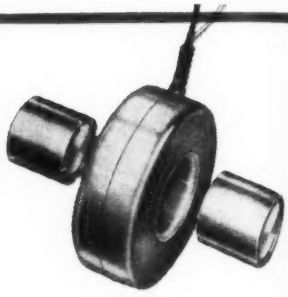

STATIONARY FIELD MAGNETIC INSTRUMENT CLUTCH
torques range from 4 oz./ins. to 430 oz./ins. Speeds up to 20,000 r.p.m.

Publication 6013A.

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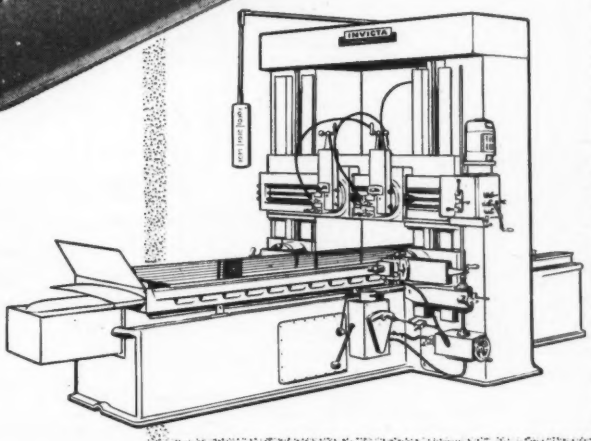
PLANERS

- **Open-sided Models 17 sizes 3' x 3' x 2' 6" up to 14' x 4' 6" x 3' capacity.**
- **Infinitely variable table speeds with quick return.**
- **Hydraulic tool lift.**
- **Automatic lubrication of bed ways.**
- **Rapid vertical traverse of cross rail standard.**
- **Centralised controls.**

TWELVE DOUBLE COLUMN MODELS
8' x 4' x 3' — 14' x 5' x 3'



Additional tool head on cross rail. Milling heads. Grinding heads. Rapid cross traverse of heads. Outer support for cross rail. Concertina guards for all ways are available to order.

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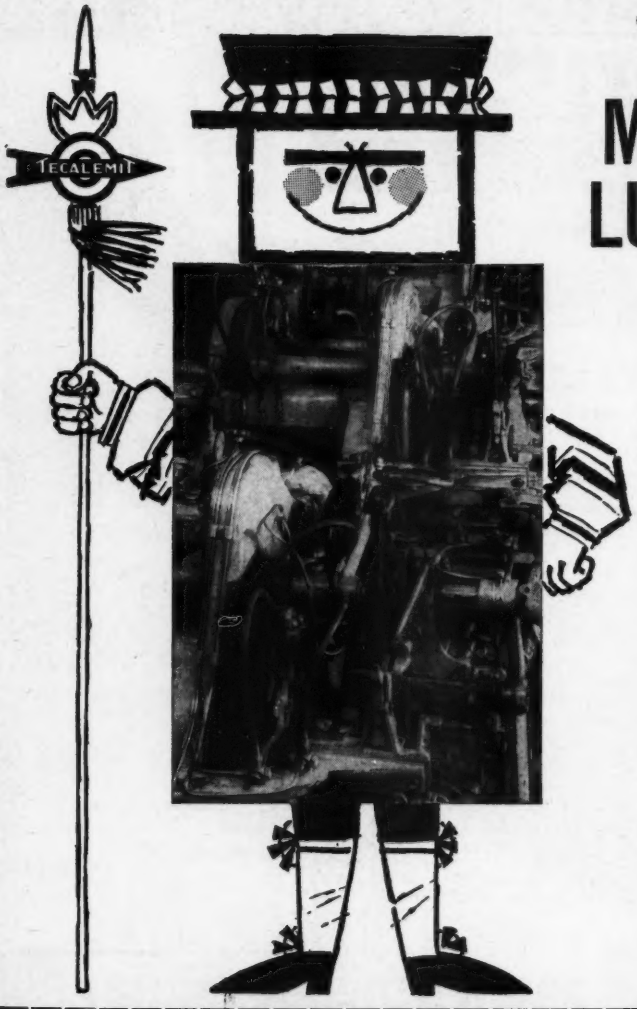

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Tecalemit Mechanical Greasing Systems guard every bearing. Fitted into new designs or existing machinery, they ensure correct greasing at the correct intervals, eliminate neglect and error, and immensely increase the working life and efficiency of your machines. And by cutting out hand greasing, they add much to works safety.

The two main grease systems are suitable for every type of installation.

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has a central pump—fully automatic, operator controlled, or hand operated—and a single main distributor line, feeding each bearing through a separate single-line injector, each of which is independently regulated.

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is fully automatic, and uses 19 miniature pumps to serve individual bearings. Each pump's output is pre-regulated. The unit can be driven from the machine it serves, or supplied with its own electric motor.

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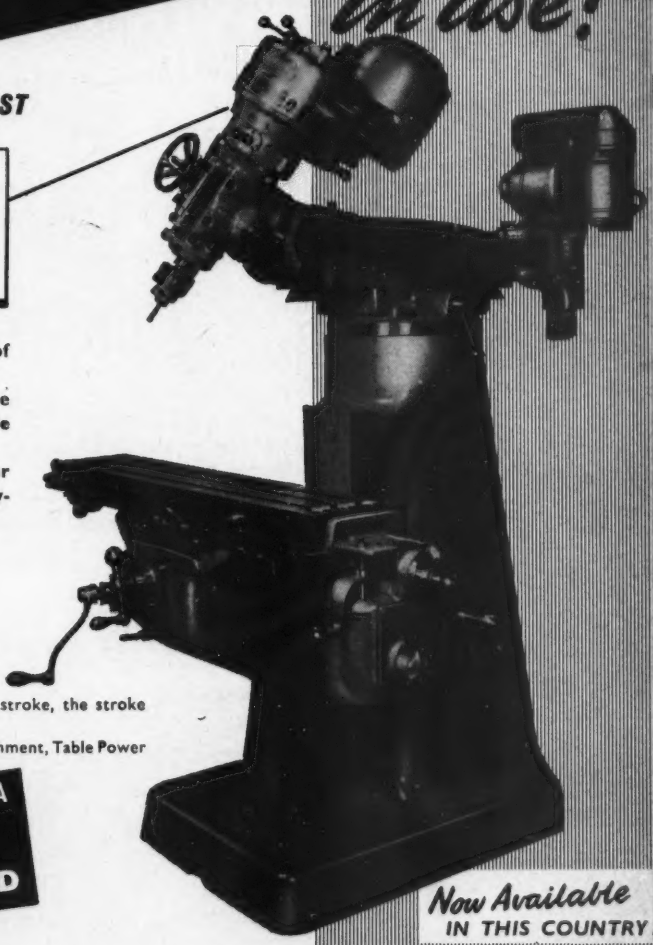

- **Head can be set in 2 planes by means of worm gearing.**
- **Ram can be re-positioned over the table without re-checking squareness of spindle to table top.**
- **Rear end of the ram is designed for mounting of Milling, Shaping or Cherrying Heads.**
- **Table sizes 32", 36", 42", 48" x 9".**
- **Cross travel 9" or 12".**

Other attachments available

Model "T" Cherrying Attachment.
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2D and 3D Hydraulic Duplicators, Measuring Attachment, Table Power Feed Unit, etc.

THE NEXT BEST THING TO A BRIDGEPORT MILLER IS A BRIDGEPORT HEAD

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Your Auto is NOT Fully Automatic without

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Here's Why...

A Reloading time cut to 4 seconds.
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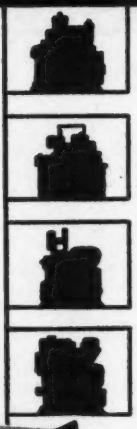

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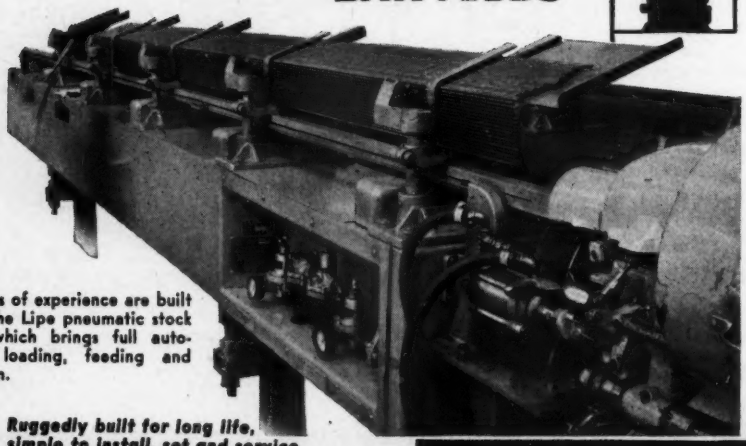
LIPE FULLY AUTOMATIC PNEUMATIC **BAR FEEDS**



Years of experience are built in to the Lipe pneumatic stock feed which brings full automatic loading, feeding and ejection.

Ruggedly built for long life, simple to install, set and service.

Models cover range from ⅛in. to 1¼in. bar and ¼in. to 1½in. tube.

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DOUBLE ENDED PRECISION FINE BORER MODEL AL 4

With automatic cycle this exceedingly precise machine is designed for repetition fine boring. Single or multiple fixtures can be accommodated on the large table. The double ended boring heads permit boring from both sides on the same or on parallel axes at the same work setting. Setting the cycle is effected by positioning trip dogs on interchangeable cam plates which can be pre-set. Rapid traverse is provided. Single or double-ended machines with one, two or four boring heads are available and many useful items of equipment also.

Boring capacity 4½". Spindle speeds 300 to 5000 r.p.m.
Feeds (40) ⅛" to 11" per min. Table traverse 19". Table size 16½" x 10".

SEE *THIS MACHINE* *at our* *SHOWROOMS*

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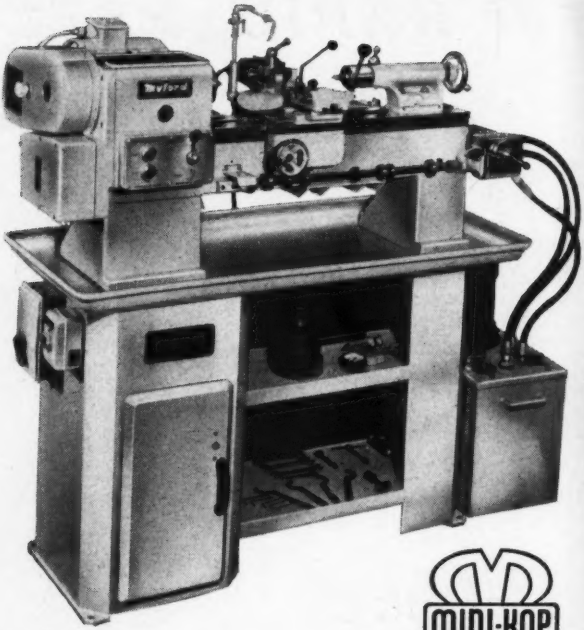
196

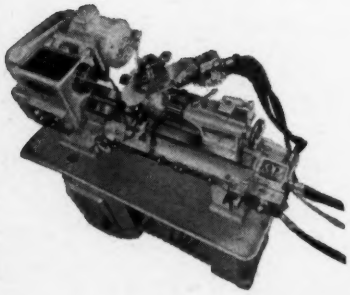
a high-speed hydraulic copying lathe for small parts



MINI-KOP

Myford MINI-KOP

SERIES 1A



Specifically designed for copy-turning small components up to 1 inch diameter. This is a **fully** hydraulic machine with hardened bed . . . hydraulic carriage motion has instantly variable feed-rate control and fast traverse in either direction . . . alternative reproducer approach angles . . . and many other features to facilitate small component copying.

Automatic length stops accurate within 0.001 inch.
Will reproduce steps as small as 0.0005 inch.
Will reproduce profiles within 0.001 inch on the diameter.
Will repeat diameters well within 0.001 inch.
Spindle speeds to over 4,000 r.p.m.
Costs little more than many copying attachments.

See this machine at Stand No. 37, at the Engineering, Marine Welding and Nuclear Energy Exhibition, Inner Row Gallery, Grand Hall, Olympia.

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Myford Ltd BEESTON NOTTINGHAM TEL: NOTTINGHAM 254222

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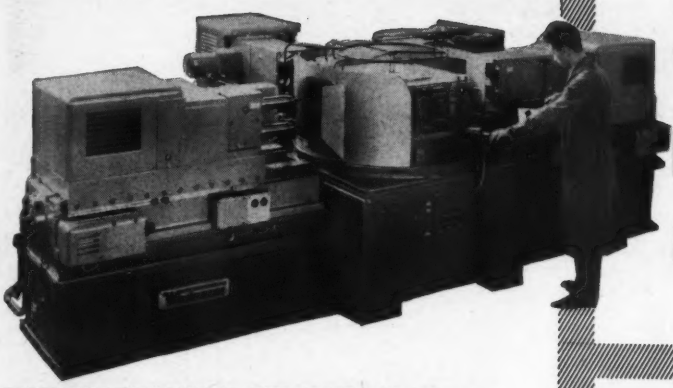
range of

Vertical and Horizontal Fine Borers...



THREE WAY HORIZONTAL FINE BORER with rotary table for rough and fine boring, facing and chamfering connecting rods.

THREE SPINDLE VERTICAL FINE BORER with automatic loading and indexing table. Fine boring piston gudgeon pin holes.

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THE NEW MURAD EG8 DUSTLESS GRINDER

- *Filter Resistance Halved*
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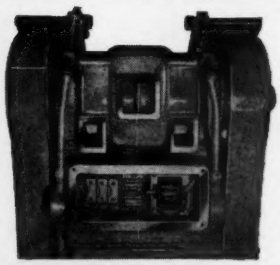
These are some of the many improvements embodied in the new EG.8 making it without question the best off-hand Grinder in the world. The Murad Dustless Grinder is unique. It embodies its own dust inhibitor which offers protection to both worker and employer and makes the provision of a separate dust extraction plant unnecessary. It can be placed anywhere in the shop to suit the sequence of operations, even in close proximity to precision machines without endangering their slides. The repeat order is the finest tribute that a customer can pay to the efficiency and reliability of a machine tool. Britain's industrial giants have paid this tribute to the Murad Dustless Grinder.

Amongst many Users who send us a constant stream of repeat orders are such world-famous firms as Mullards, Pressed Steel, G.E.C., Atomic Energy Authority, B.T.H., British Oxygen Gillette Industries, Skefko, etc., etc.



Control switchgear is designed into the machine and not added as an afterthought.

The above illustration shows the eyeshield swung up for ease in changing lamps, etc.

Pat. No. 674748

Murad DEVELOPMENTS LTD.

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GOODYEAR GREEN SEAL V-BELTS

* **A new range of belts with up to 100% higher horse-power ratings**
* **Now available at little or no extra cost**

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The V-Belt with 100% higher horse-power rating at fractional extra cost. This type is also static conducting, oil-resisting and dimensionally stable under all stocking conditions.

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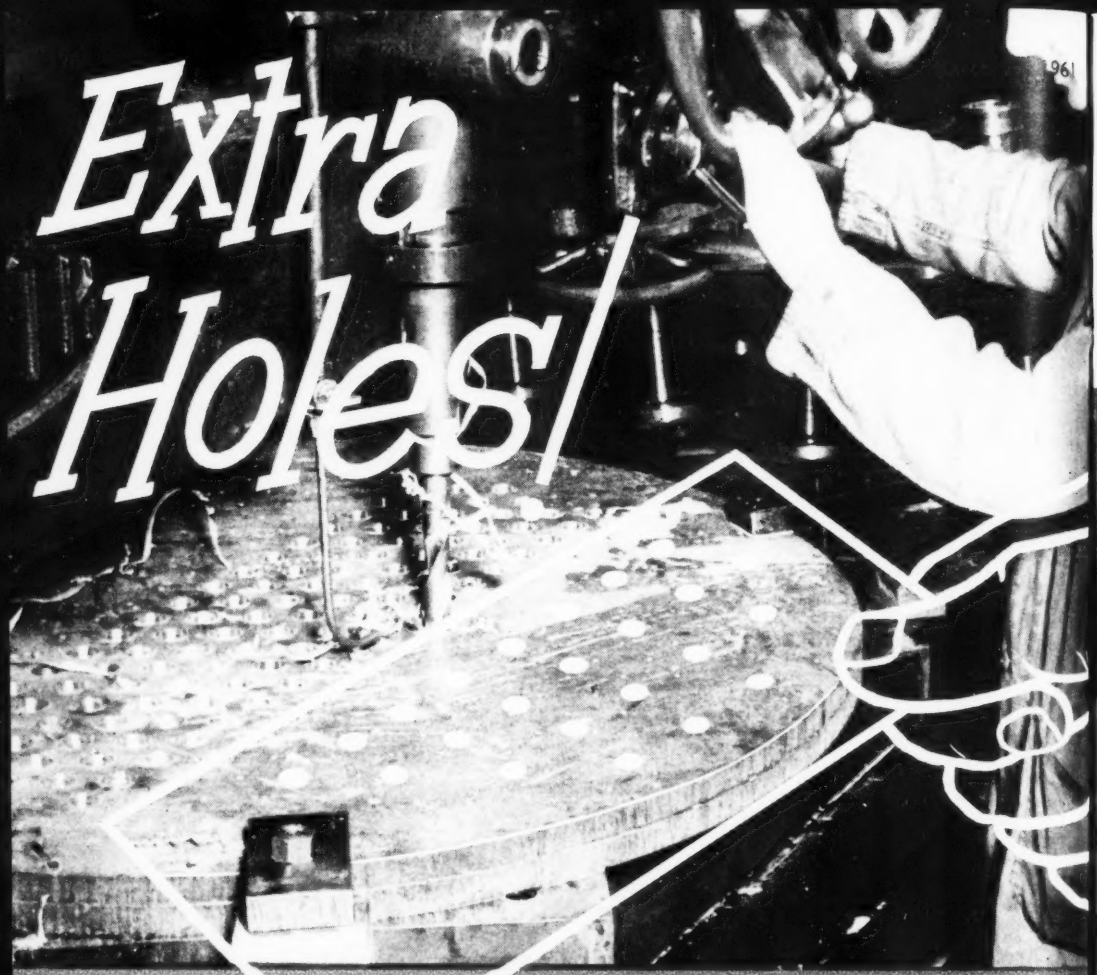

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MAKERS OF THE FINEST TWIST DRILLS

—BY ANY STANDARD

Exceptional performances from an odd drill in a batch are of little value to the regular user of Twist Drills. Multiple drilling, repetitive drilling, production drilling, demand consistency in the working life of each tool, therefore the capacity of obtaining extra holes from **every** drill is an obvious advantage. The manufacture of DORMER Drills is keyed to this very principle.

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SHEFFIELD **ENGLAND**

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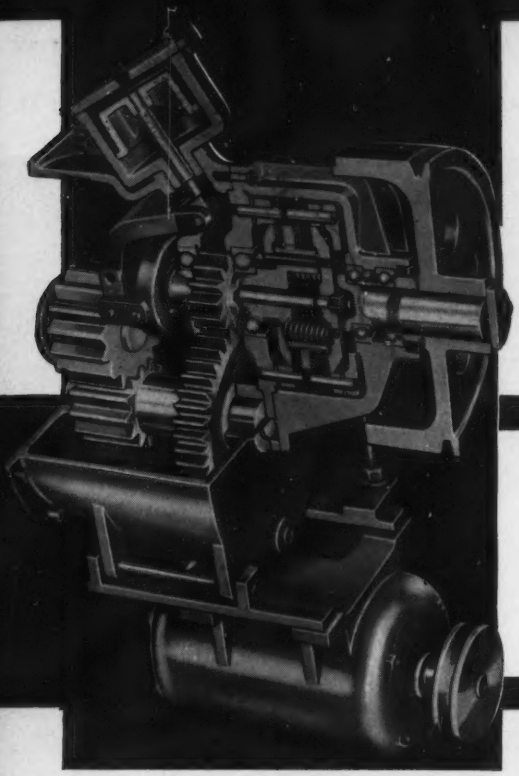

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with this *Unique* INTERCHANGEABLE DRIVE

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AIR CLUTCH *INCLINABLES*

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- WELDED STEEL FRAMES GIVE BIG VARIETY OF SIZES
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MACHINE TOOL CO. LTD.

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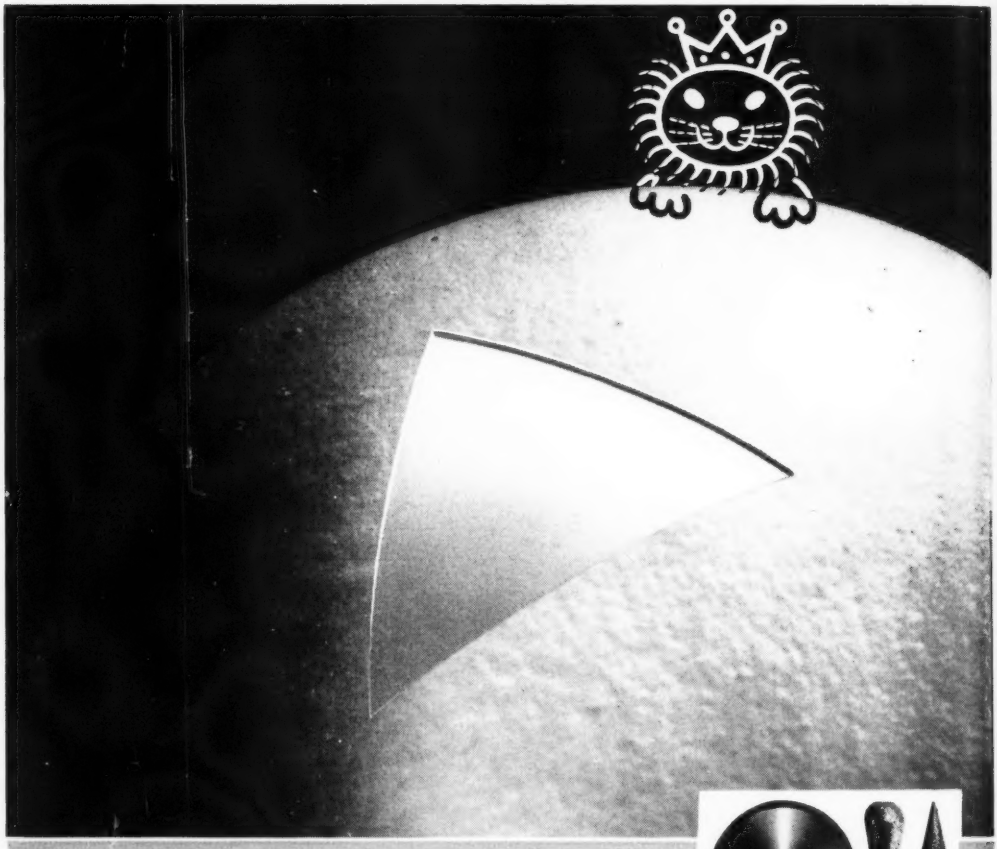

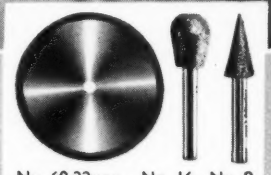

No. 60 22mm. No. 16 No. 8

No. 60 is the disc used in operation Eggshell.

cackle-shell heroes...

Even the little lion could hardly believe his eyes. But there it was—a specially designed diamond tool neatly cutting out a triangle of egg-shell, **without so much as damaging the membrane underneath!**

The chaps who designed this amazing little tool—the Cackle-shell Heroes in our back room—just revel in these "impossible" problems. May they take a look at yours?

DIAMOND PRECISION TOOLS LTD.

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This bit is big news
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There are sound reasons for using "Super Capital" High Speed Steel Toolbits. The high quality steel is production controlled and tested, in Balfour's own works, from the melt to the finished product. Toolbits are subjected to a specialised heat treatment to ensure extra life and durability. They satisfy the needs of users who require maximum performance at no extra cost. These qualities ensure that a change to "Super Capital" is a change for the best. *Available in Sheffield, and also from branch office stocks in London, Birmingham, Manchester, Cardiff and Glasgow.*

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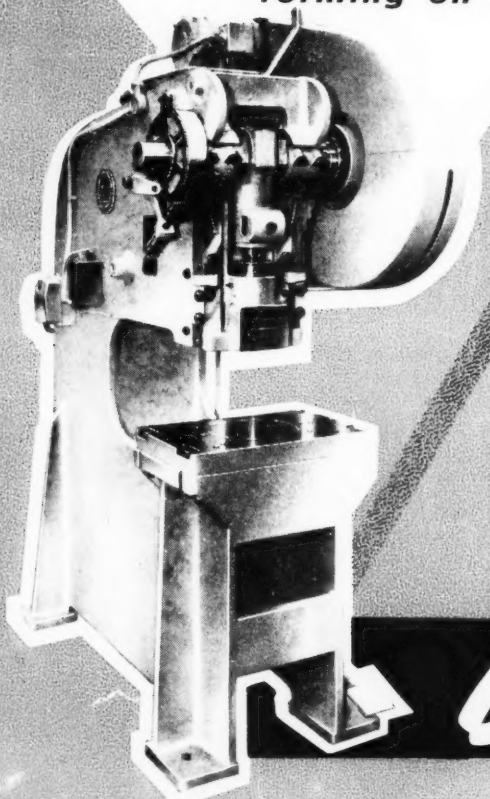
DEEP THROAT PRESSES

for high speed cutting, punching and forming on large wide sheets



Here is a new Bliss Press with features to boost production and cut operating costs. These presses have been designed for use where holes are to be punched or blanks cut at a distance from the edge of a wide sheet.
The range includes two bench models of 2½ and 5½ tons capacities and six floor models in capacity ranges 10 - 60 tons. All complete with parts interchangeable with Bliss Bench and Inclinable Presses of similar tonnages.
Standard features include: fully stress-relieved frame; rolling key clutch; extra long gibs and heavy duty precision-forged steel crankshafts.

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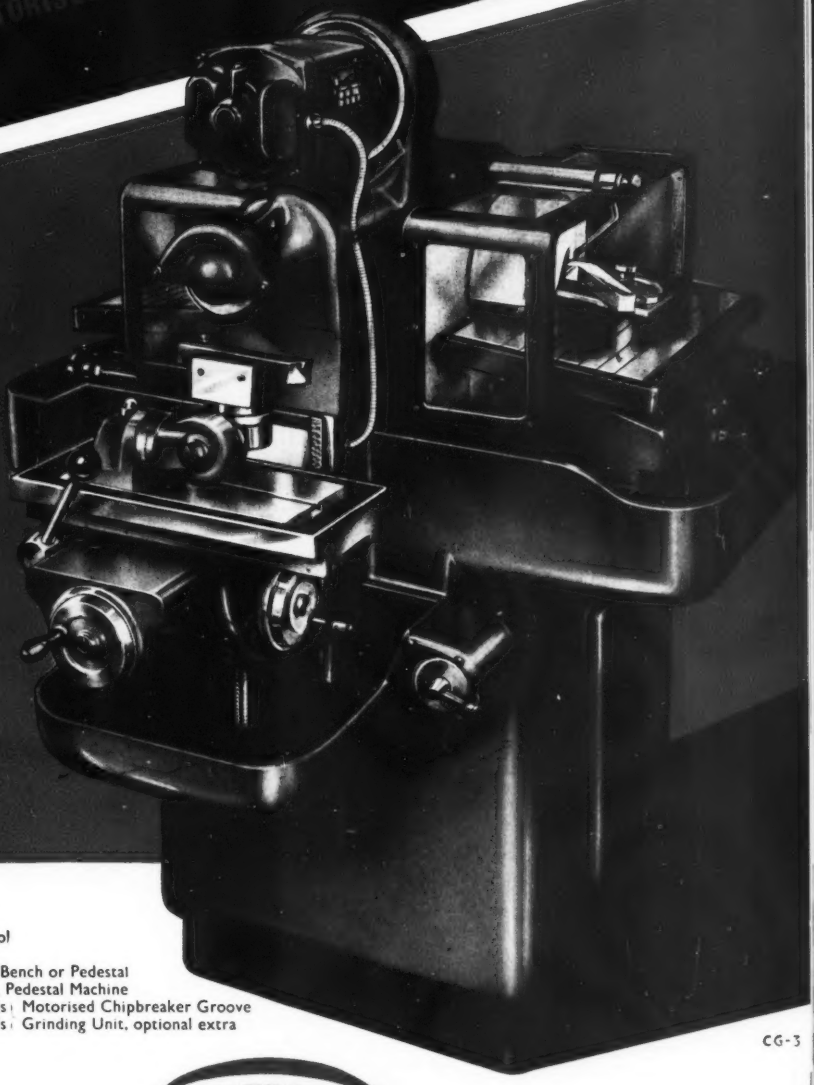
ABWOOD 'CONCENTRE' CARBIDE TOOL GRINDER

WITH MOTORISED CHIP-BREAKER GROOVE GRINDING UNIT Model CG2A



- Constant centre height of table to grinding point irrespective of angle
- Adjustable taper roller bearings eliminate end float
- Perspex panelled spray guards provide perfect vision, hinged for easy access to wheel
- Uses diamond wheels to their maximum efficiency
- The Chipbreaker Groove Grinding Unit accommodates turning tools of most shapes and sizes

Our full range of Carbide Tool Grinding Machines includes:
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CG-3

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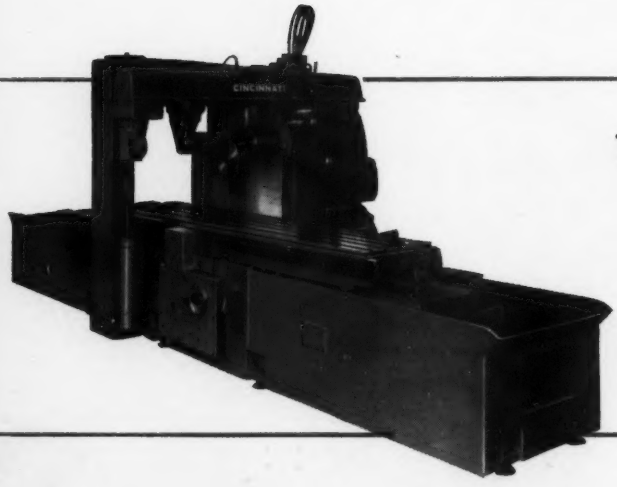

TRACER CONTROLLED STYLES

embody all the features of standard HyPowermatics PLUS the ability to perform CONTOUR MILLING operations through a hydraulic tracer valve and form cam.

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PLAIN, DUPLEX & TRACER CONTROLLED STYLES

A FULL RANGE OF

168

STANDARD SIZES

to fulfil modern production requirements

HyPOWERMATICS Rugged, heavy duty, production milling machines — with *168 standard* sizes from which to choose.

Table Widths— 18", 22" & 26" wide.

Table Travels— from 36 inches to 14 *feet*.

Spindle Carriers— three sizes from 10 h.p. to 50 h.p.

Table Feeds— infinitely variable from 1/4 to 150"/min.

CINCINNATI EXCLUSIVE FEATURES!

Automatic Variable Table Feeds— ensure constant use of maximum horsepower.

Hydramech Table Drive— embodies *automatic* backlash eliminator and provides maximum driving force directly beneath the cutter regardless of table travel.

Dynapoise Overarm— absorbs cutter vibrations leading to improved surface finish and longer cutter life.

PLUS

Hardened and Ground Table Ways— with automatic lubrication for long and accurate life.

Fully Automatic Table Cycles— operating reduced to movement of a single lever.

Automatic Spindle Stop— prevents marring of finish surfaces on return stroke of table.

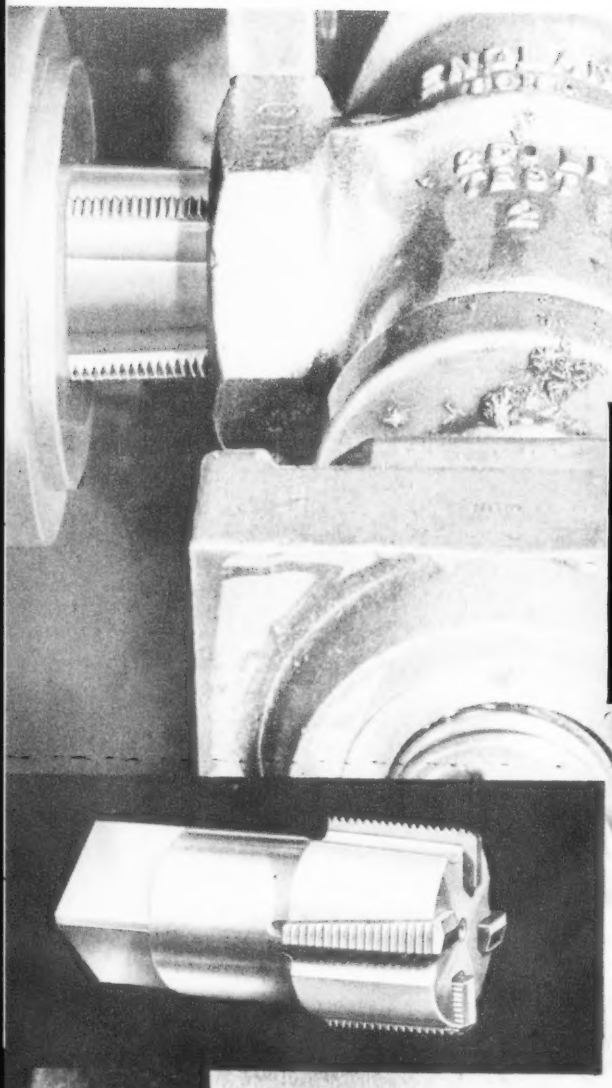
Massive Construction— ensures stability under all cutting conditions.

Unit Construction— offers "made-to-measure" machines at standard prices.

Full specifications are contained in Catalogues M-1871E (standard machine) and M-1909E (tracer controlled machine)

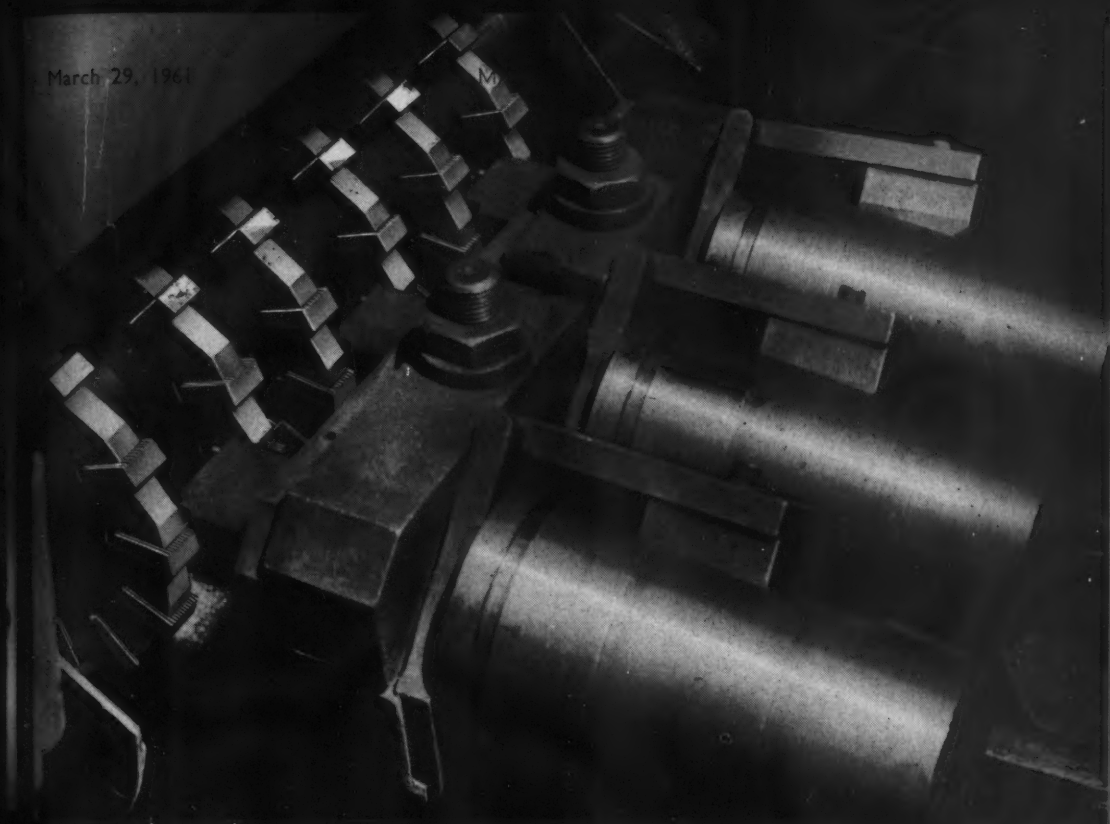
MACHINES LIMITED
BIRMINGHAM 24

AUDCO LTD USE...



Galtona

TRADE MARK



SERRATED BLADE CUTTERS AND INSERTED BLADE TAPS

Our illustrations show the tapping of valve bodies, 2" B.S.P.T. both ends simultaneously and gang milling the square ends of valve plugs.

Our Tool Engineers will be happy to co-operate on your own production problems and we invite you to get in touch with us.

AUDCO LIMITED of Newport, Shropshire, rely on GALTONA serrated blade cutters and GALTONA inserted blade ground thread taps for high production, precision and long life.

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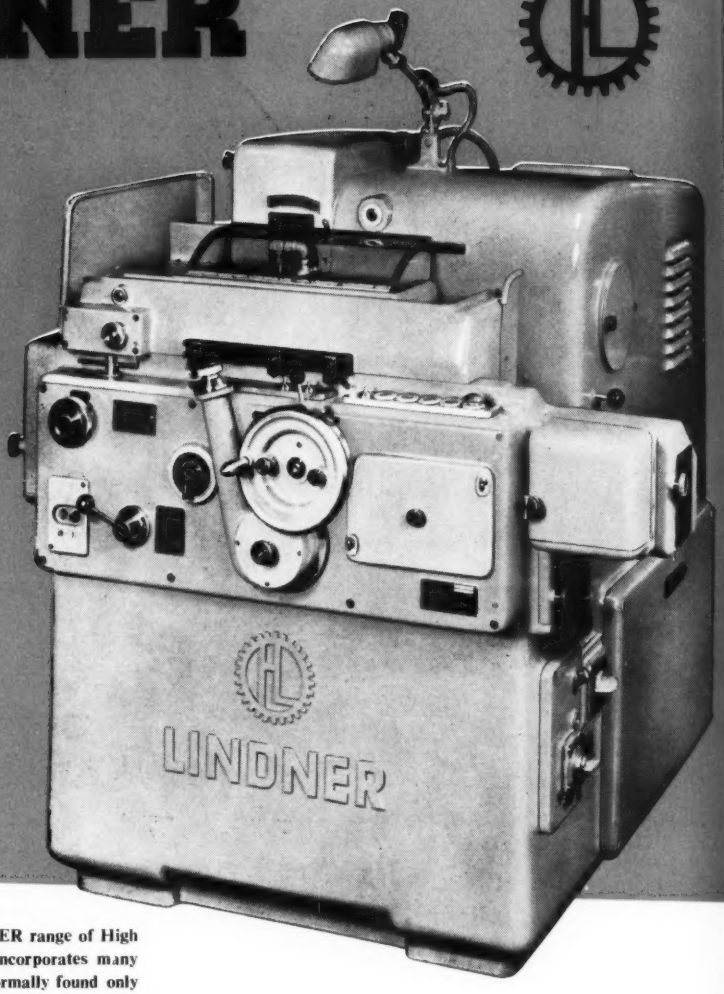
LINDNER GE

'MAXIMUM SIMPLICITY... MAXIMUM ECONOMY'

THREAD GRINDING MACHINE



This smallest machine of the LINDNER range of High Precision Thread Grinding machines incorporates many of the famous LINDNER features normally found only on larger and more expensive machines.

Two models of this highly efficient machine are available

Model A: High Precision Thread Grinding Machine of highest accuracy for the grinding of external threads and annular forms, employing either the single or multi-rib wheel, particularly suitable for producing thread plug gauges, measuring and micrometer screws.

Model B: As Model A but with a relieving attachment intended for the production of both straight and spiral fluted taps, and also gives excellent results when used to produce highly accurate threads on small component parts.

Both models will accommodate up to 1in. (25 mm) diameter by 7½in. (190 mm) long
Maximum length of thread ground 3½in. (90mm)
Maximum swing over table 2⅜in. (60 mm) wheel diameter 20in. approx. (500 mm).
Provision is made for grinding threads of perfect form from 200 to 6 TPI (125 mm to 4 mm pitch)

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MACHINE TOOL CO

192-204, PENTONVILLE RD, LONDON, N.1

Telephone: TERminus 3699

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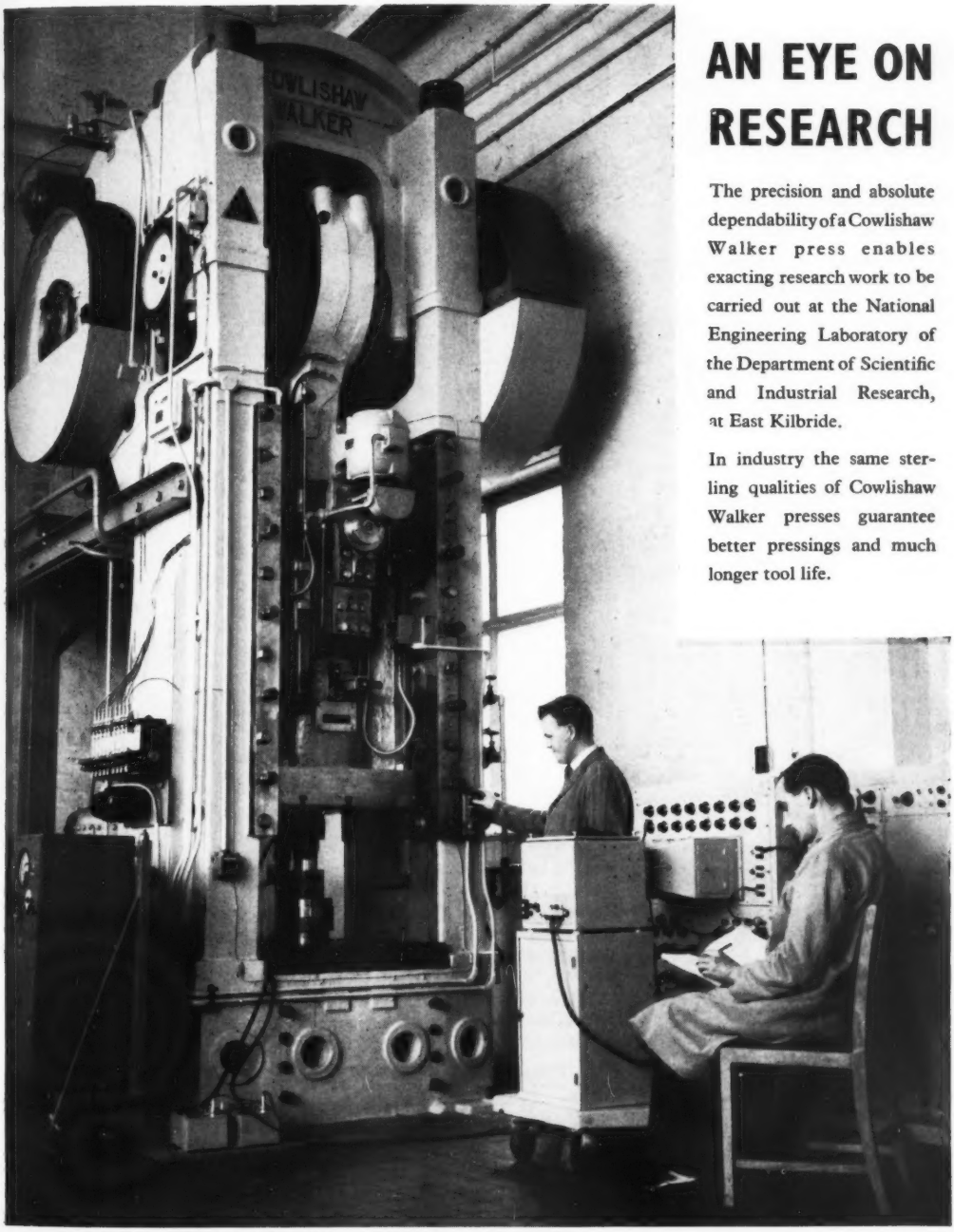

AN EYE ON RESEARCH

The precision and absolute dependability of a Cowlishaw Walker press enables exacting research work to be carried out at the National Engineering Laboratory of the Department of Scientific and Industrial Research, at East Kilbride.

In industry the same sterling qualities of Cowlishaw Walker presses guarantee better pressings and much longer tool life.

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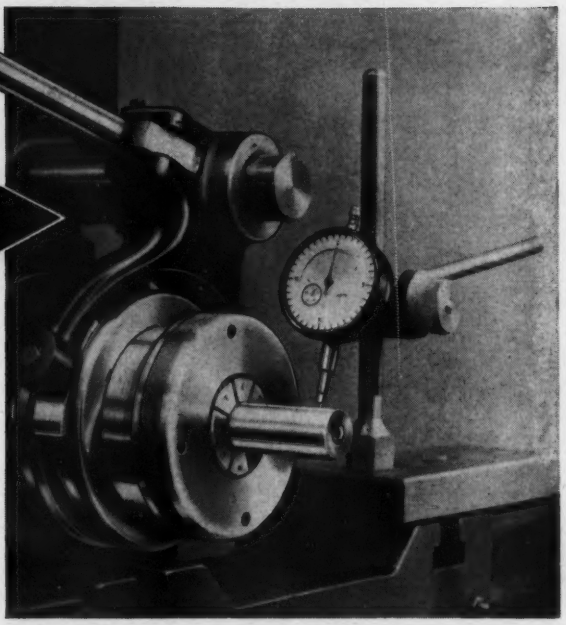
CRAWFORD RAPIDGRIP

NEW LEVER -OPERATED CHUCK



for use with Crawford Multibore Collets

This powerful new dead-length chuck is particularly suitable for bar and second operation work; fitted with a Crawford rear support stop it can hold exceptionally short pieces. It is designed for operating the Crawford Multibore Collets with their ¼" size range. There's less operator fatigue, too, because Rapidgrip's simple, powerful rack and pinion gear is easier to operate than more direct lever systems of collet closing. Another special feature is the fixed front cap which ensures constant accuracy. An independent key allows easy bore adjustment.

CRAWFORD COLLETS LIMITED

Witney • Oxon
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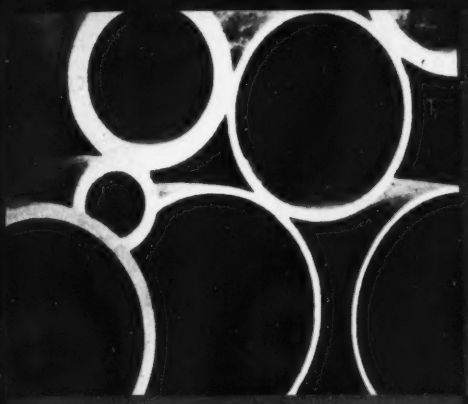

large

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NEW TIME-SAVING FROM THIS MACHINE

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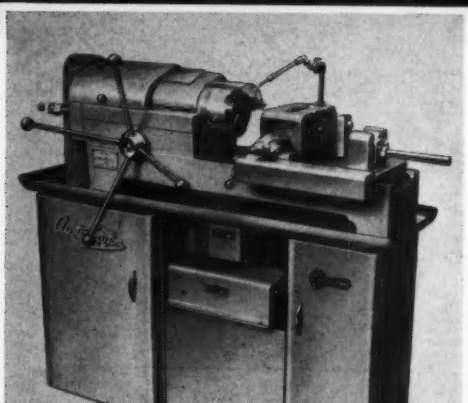
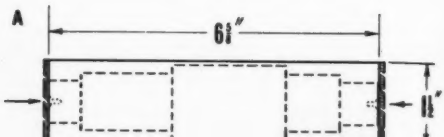


... and centre it too?



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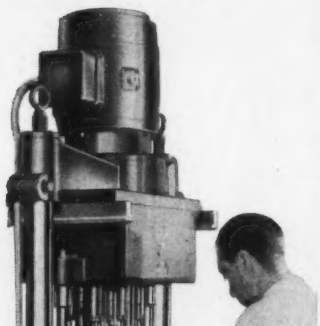
MEDDINGS

Hydraulic Multi-spindle drilling machines



These hydraulic up-stroking multi-spindle drilling machines provide fast approach, accurately controlled drilling feed and fast return of the worktable after completion of drilling. They are extremely flexible in use and can be fitted with driving motors of up to 15 h.p. — the thrust available from standard machines can be varied up to 8,000 lbs.

The machine illustrated is one of two recently supplied to a customer for the quantity production of Brake components. Provision

NEW TIME-SAVING FROM THIS MACHINE

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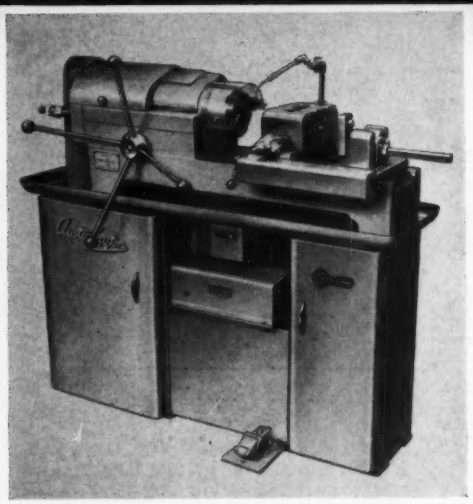
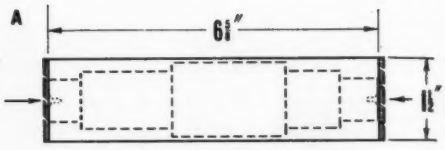


... and centre it too?



CENTRE AND FACE (Copy lathe job)

CAN YOU FACE THESE HARD FACTS—

the time you are wasting on centering and facing bar stock or forgings in preparation for your centre or copy lathe?

So here is an opportunity for NEW time-saving on a much neglected job. Hitherto, centering and facing machines have been looked upon as a luxury requiring long runs to justify their cost—Now with the economically priced (under £650 basic) and quickly set up "Centamax" every up-to-date machine shop can afford one of these machines.

By normal methods 'A' can be centred and faced on a capstan or centre lathe in 3 to 4 minutes.

By **CENTAMAX**—50 seconds in ONE operation.

If produced from a FORGING where ¼" has to be taken off the face and the job probably re-centred, time by normal methods will be at least 4 minutes.

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★ Pneumatic self-centering vice with 3¼" bar capacity.

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★ ALL-British design and manufacture.

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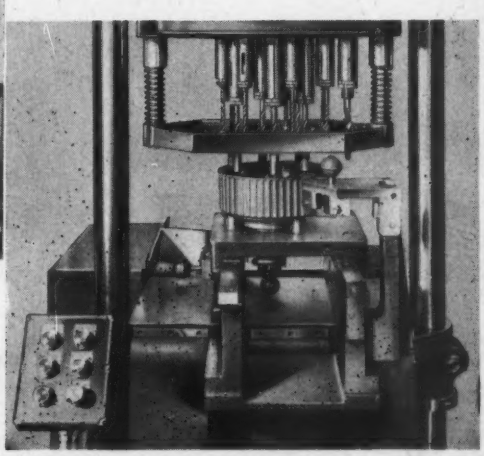
Hydraulic Multi-spindle drilling machines

These hydraulic up-stroking multi-spindle drilling machines provide fast approach, accurately controlled drilling feed and fast return of the worktable after completion of drilling. They are extremely flexible in use and can be fitted with driving motors of up to 15 h.p. — the thrust available from standard machines can be varied up to 8,000 lbs.

The machine illustrated is one of two recently supplied to a customer for the quantity production of Brake components. Provision is made for fast changeover of multi-spindle Heads and tooling, and the machines were supplied complete with all necessary jigs and fixtures built to customer's requirements.

'Patterning' of multi-spindles enables one machine to cater for a number of different parts — Heads with up to 90 spindles are in course of production.

A complete range of fixed centre and adjustable type multi-spindle Heads for attachment to existing machines, together with a comprehensive tooling service are also available.



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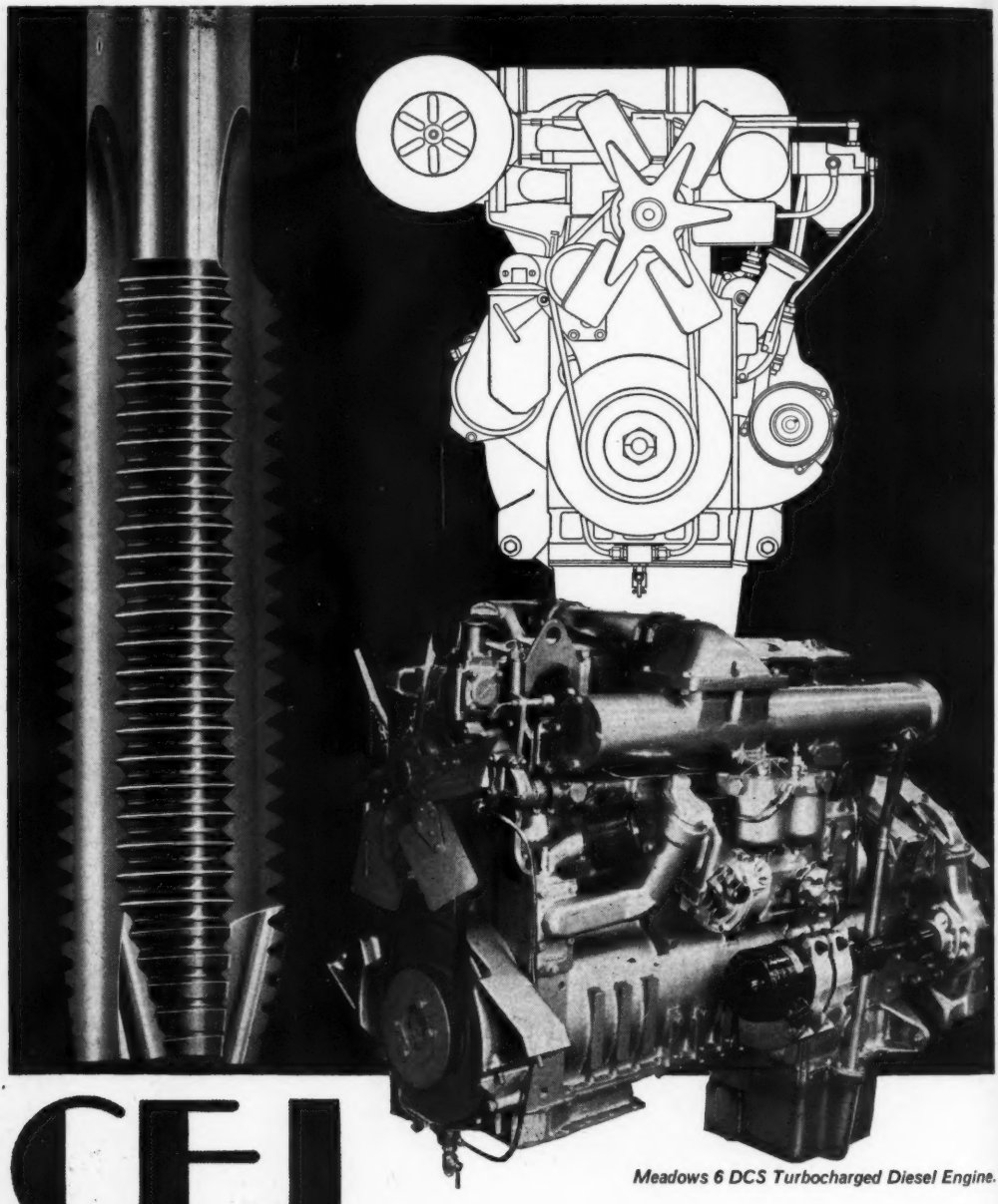

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for Ground Thread Taps

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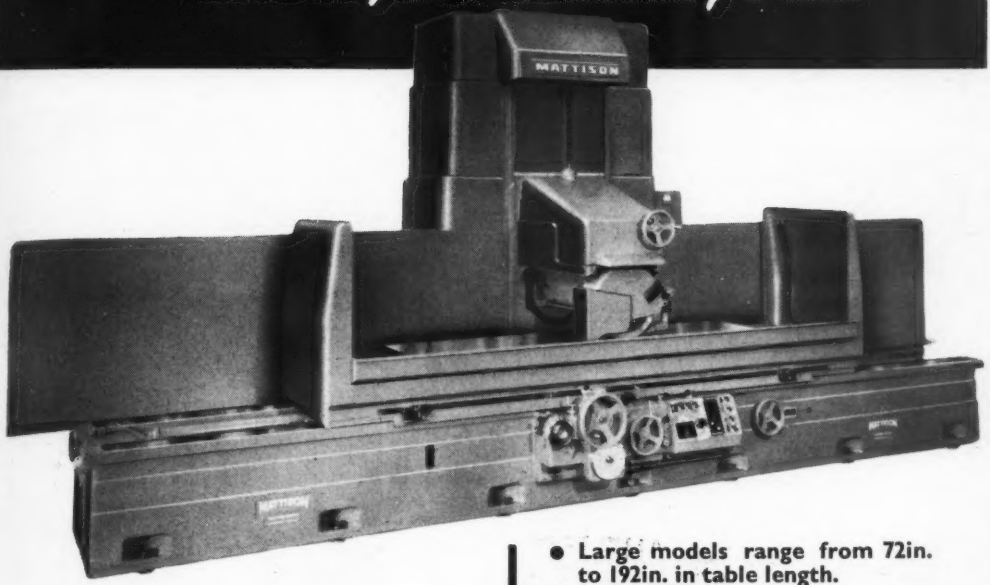
combine Greater Power with High Sensitivity . . . . .



Operation of the new Mattison is easier and more automatic because cross feed is electronically controlled in both directions. The operator presets feed inerement and reversal points on the new illuminated station . . . the wheel slide automatically feeds and stops within plus or minus $\frac{1}{10}$in. of either edge without work stoppage. Twin-cylinder actuation assures uniform speed of the cross slide. With optional automatic downfeed, electronic reversal makes grinding easier.
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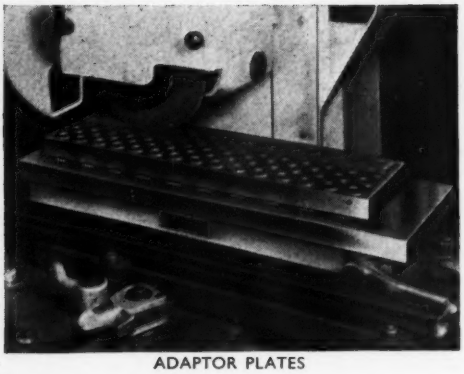

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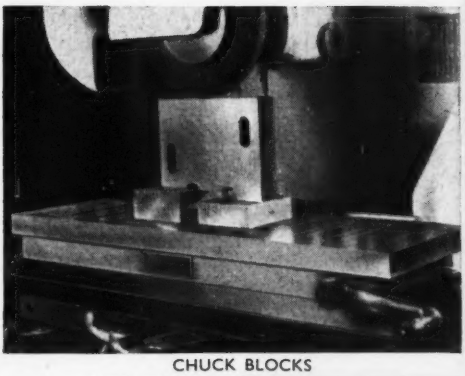

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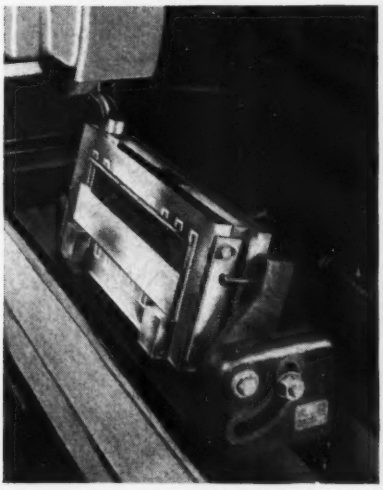

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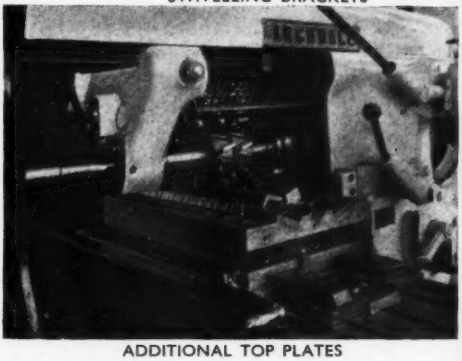

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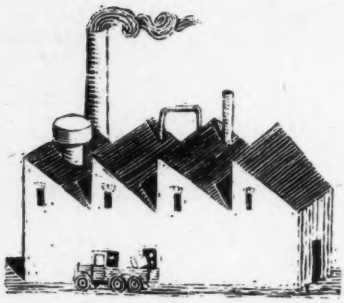

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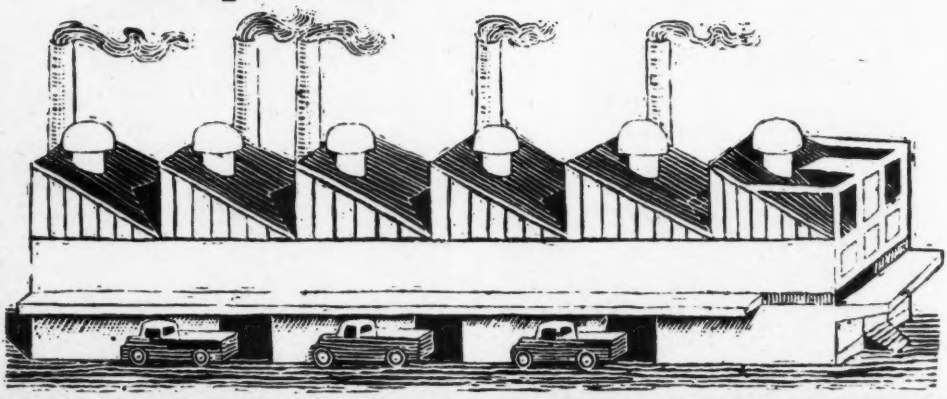

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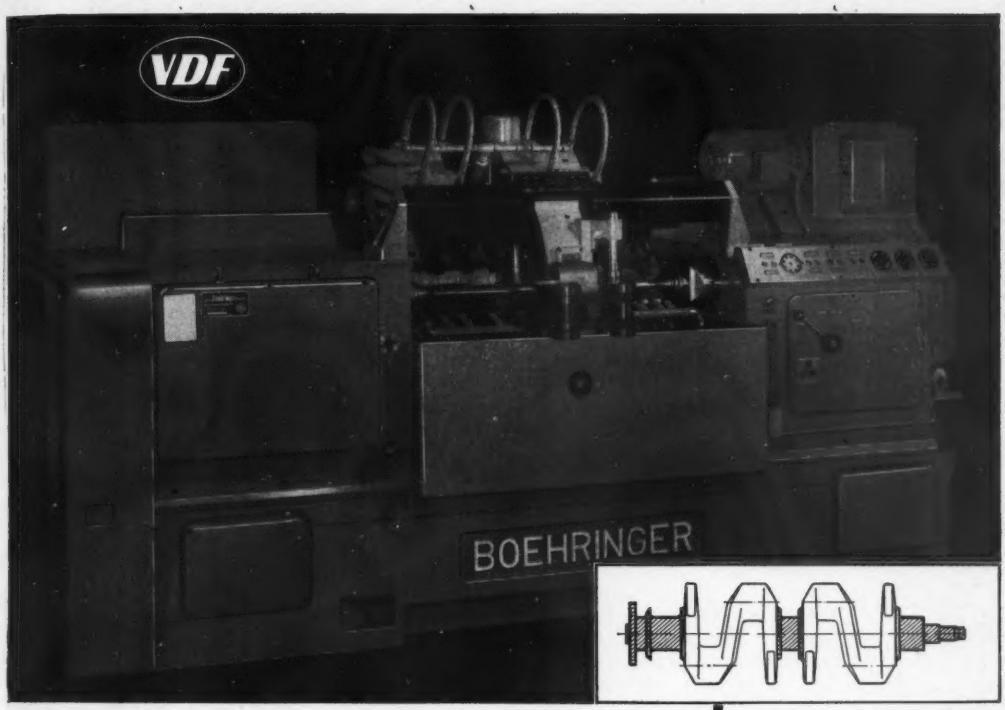

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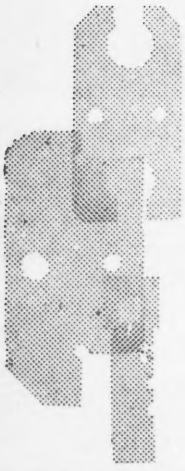

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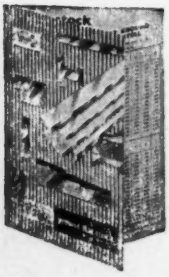

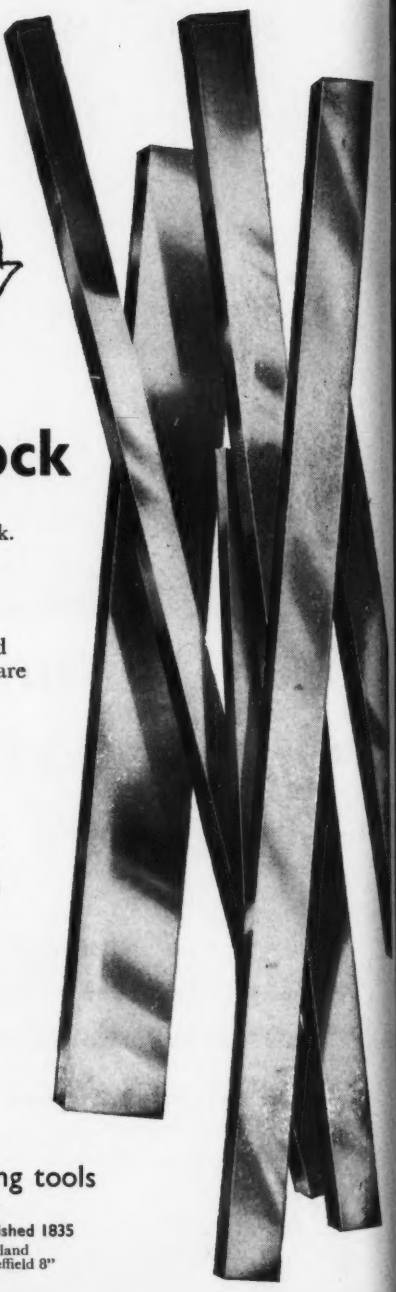

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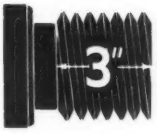
MATRIX QUALITY THREAD GRINDERS give you toolroom precision plus production line speed. Traverse grind as fine as or leads as coarse as Plunge grind threads  long in a turn and a half Wheels formed by multi-rib or single-rib diamond dressers or manual or automatic crushing units. Furthermore, crush formed wheels are ideal for grinding intricate profiles.

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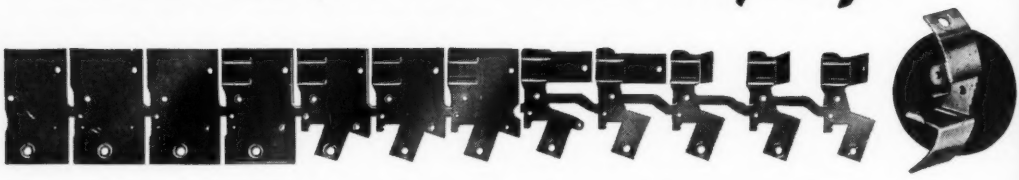

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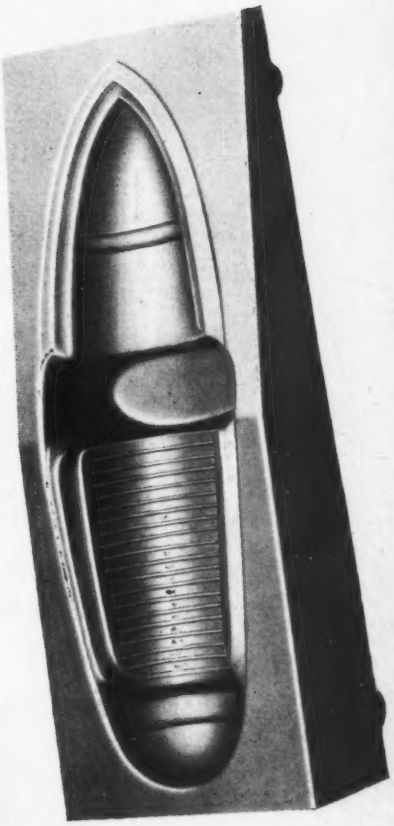

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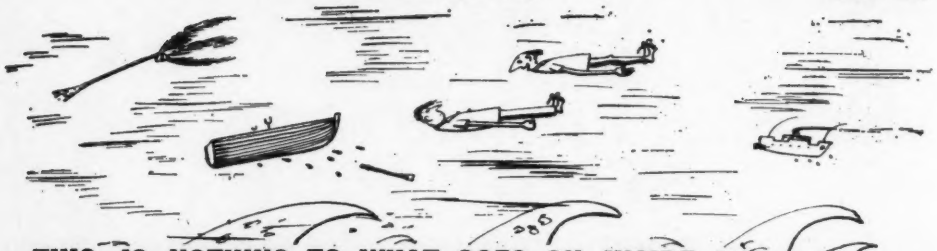

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ALMOST ENTIRELY ELIMINATES MAINTENANCE

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NO FILTERS
NO PIPES
NO NOZZLES

In this new type of Water-Wash Spray Booth the exhaust air travels at very high velocity over the water surface entraining water The air/water mixture, moving through controlled changes of direction, provides the scrubbing action.

★ **A NEW PATENTED PROCESS OF WATER TREATMENT** **substantially increases the efficiency of these Booths.**

NO CLEANING OUT AFTER 1 YEAR'S CONTINUOUS DOUBLE-SHIFT WORK AT

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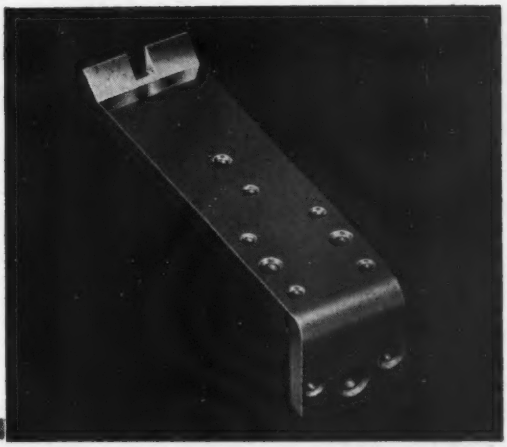

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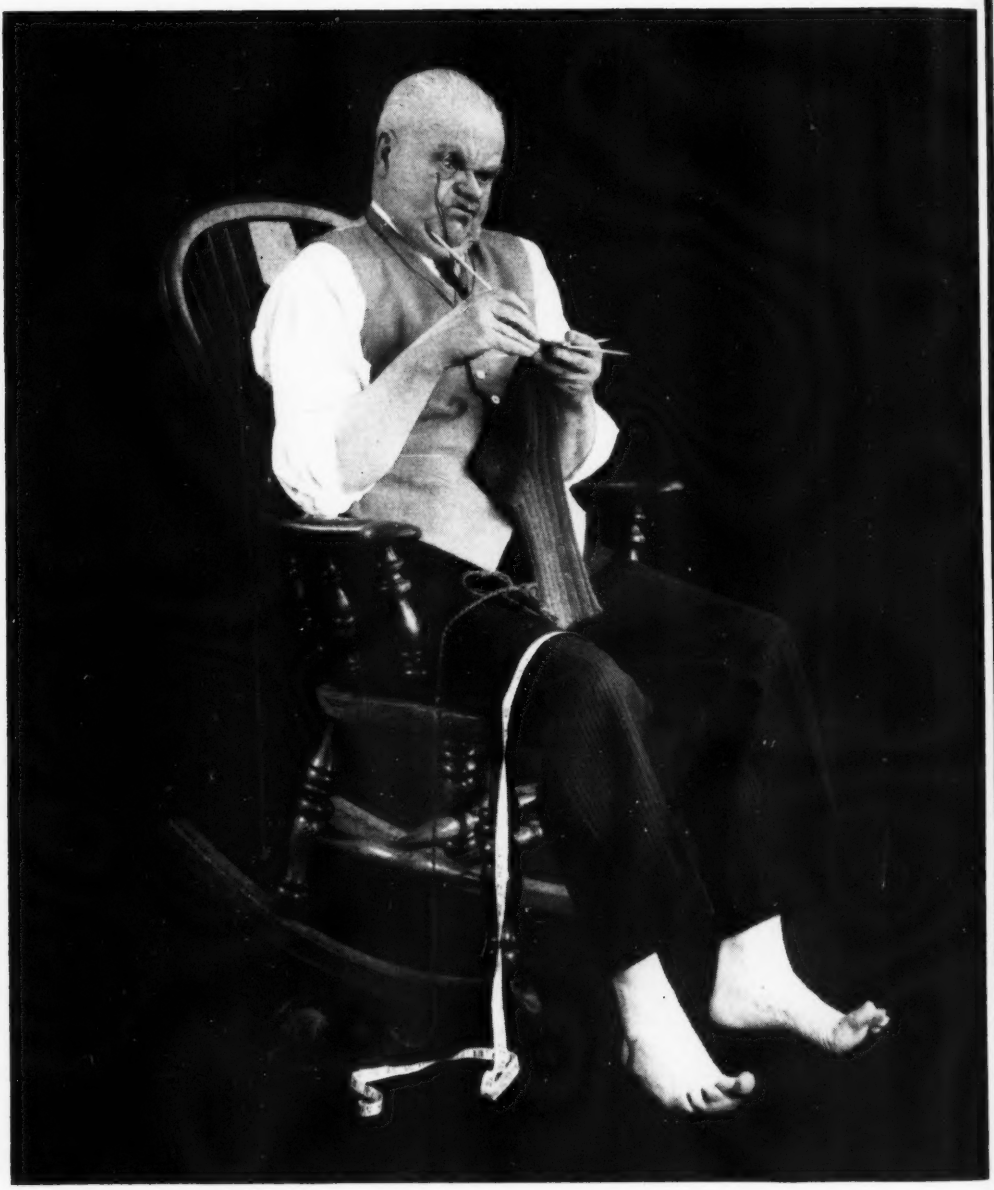

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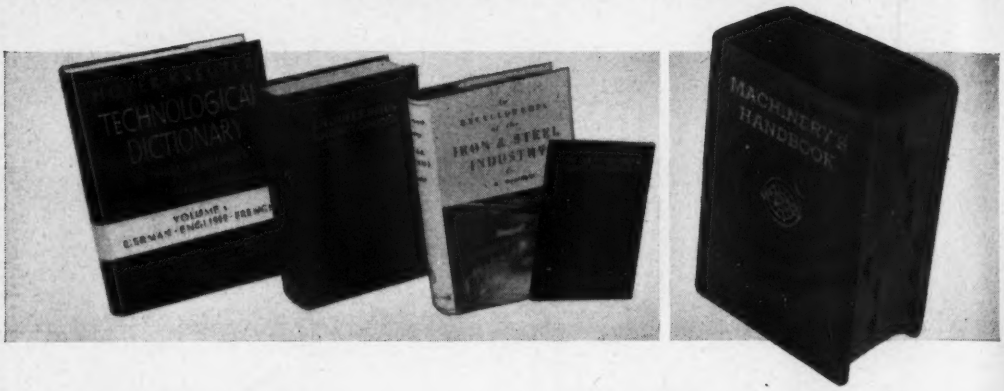

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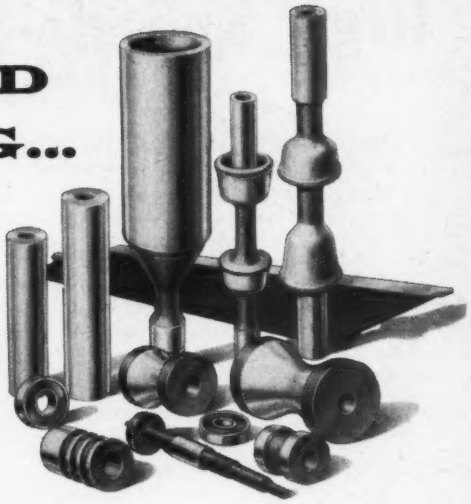

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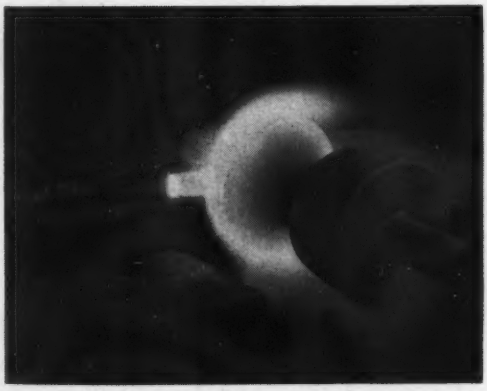

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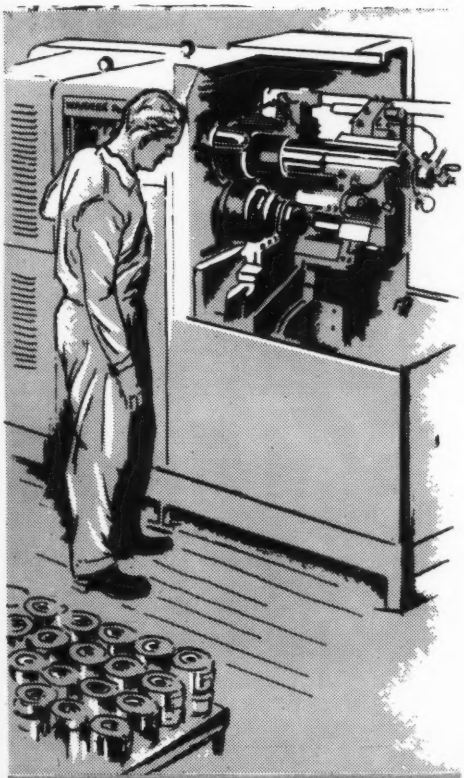

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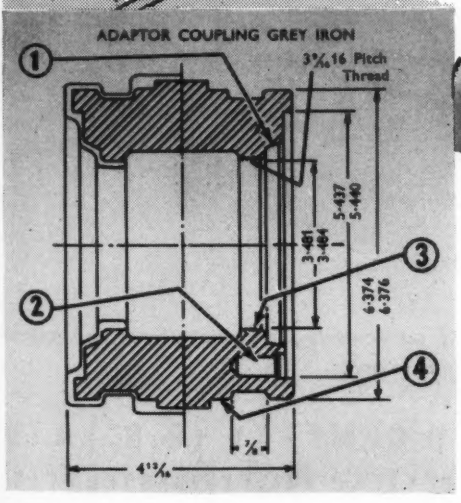

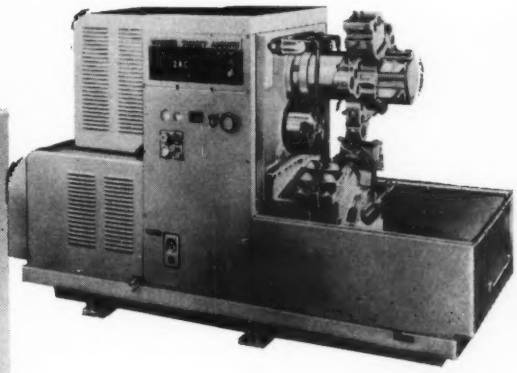

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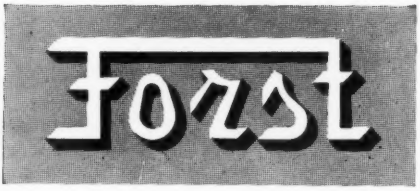

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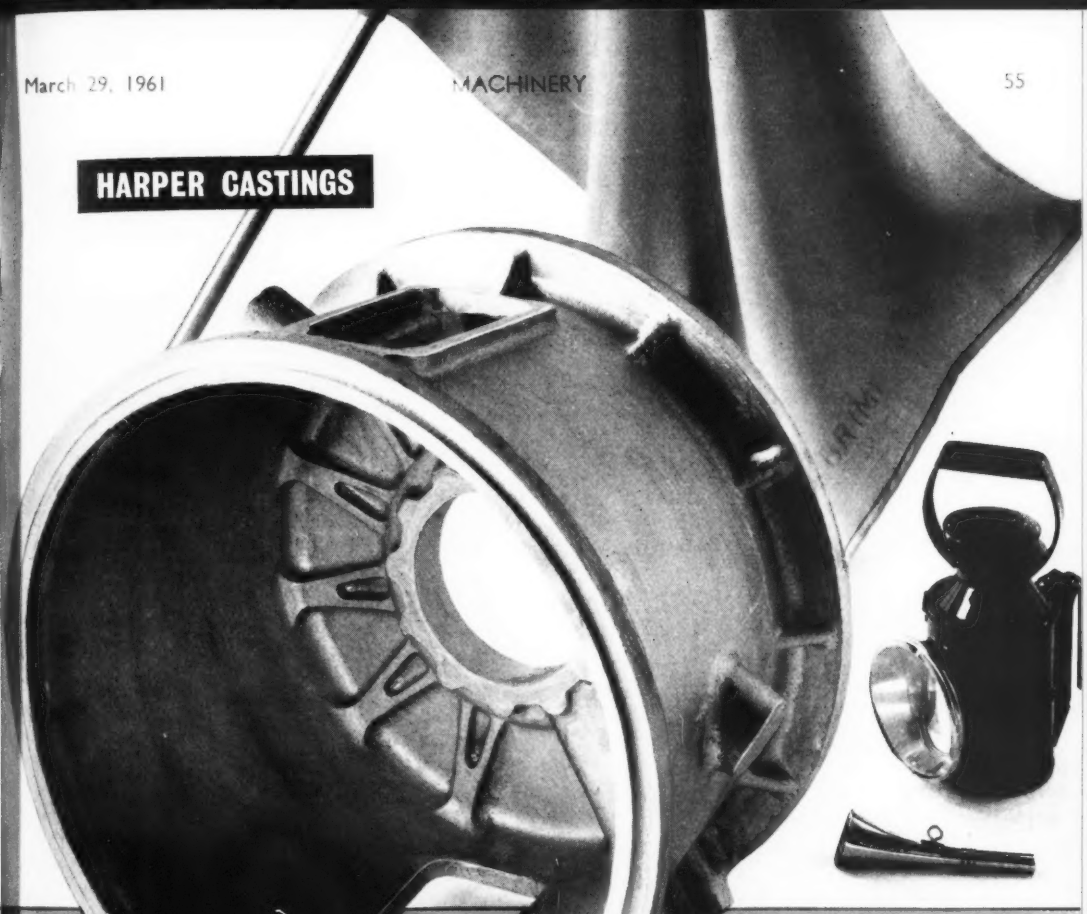

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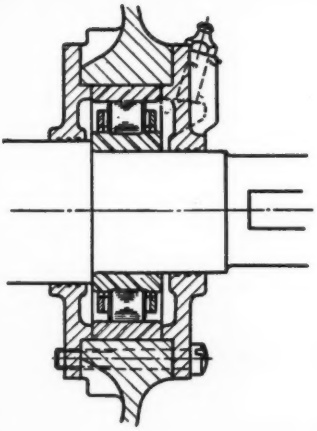

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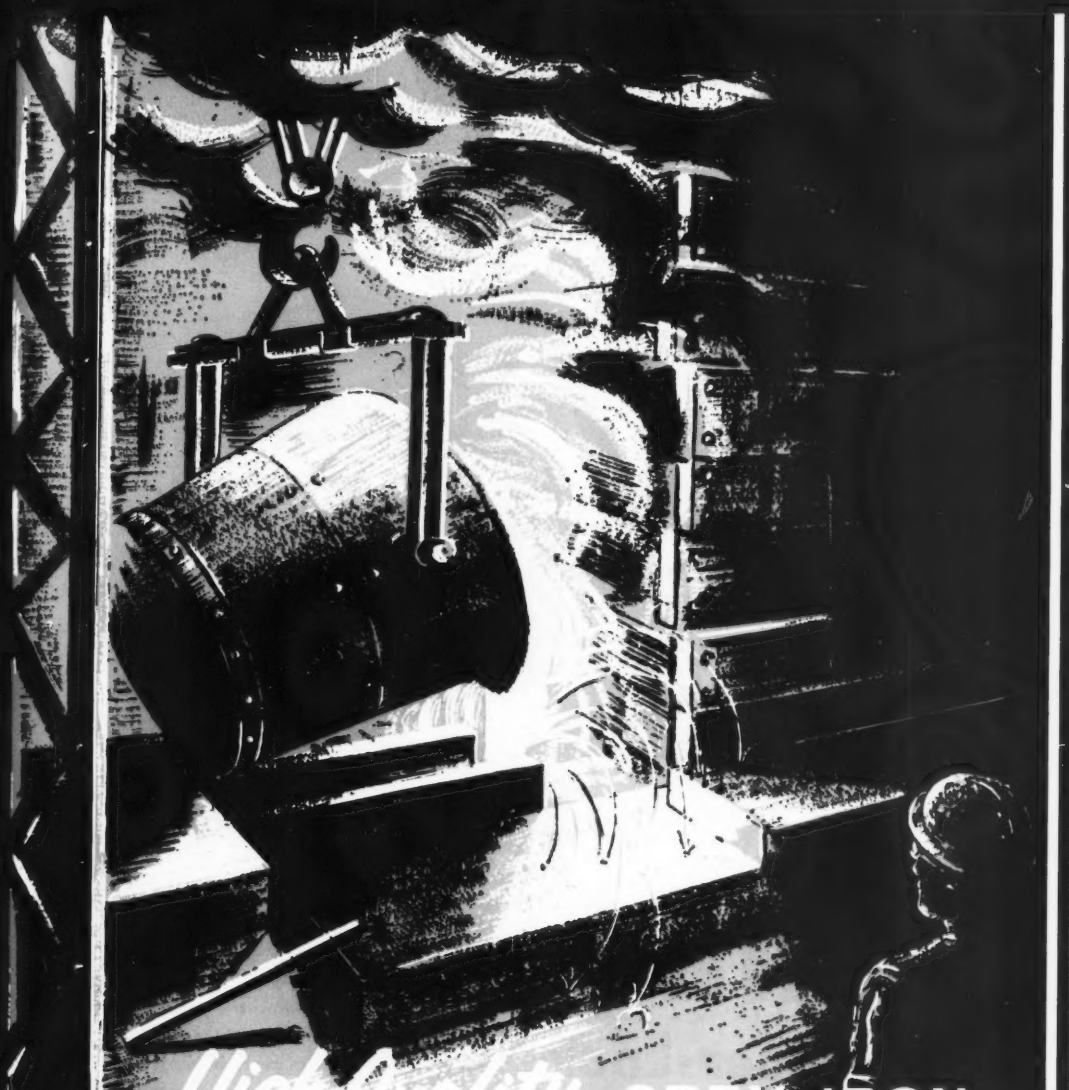

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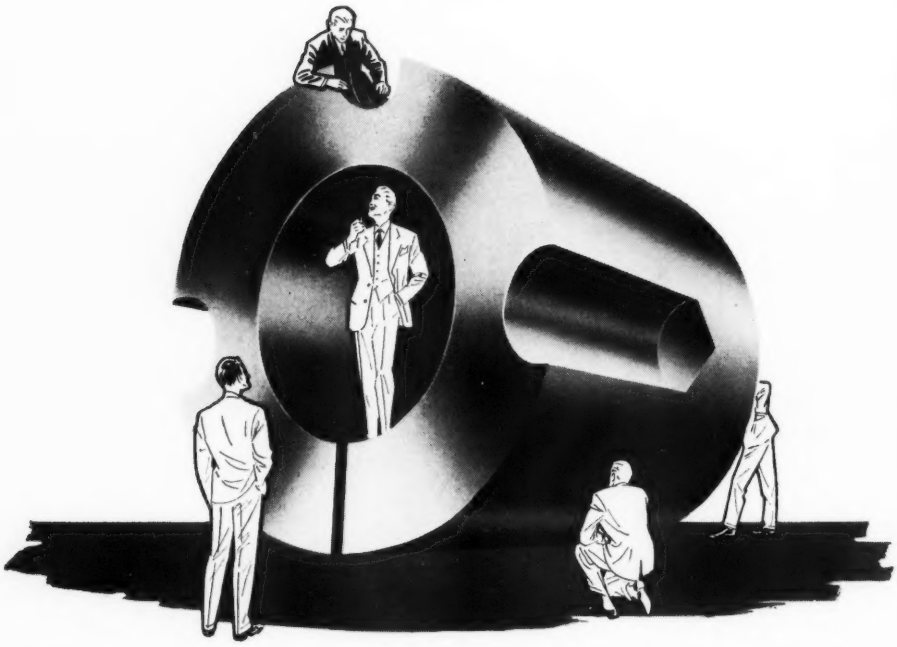

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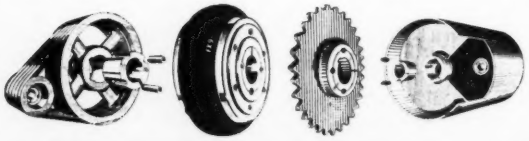

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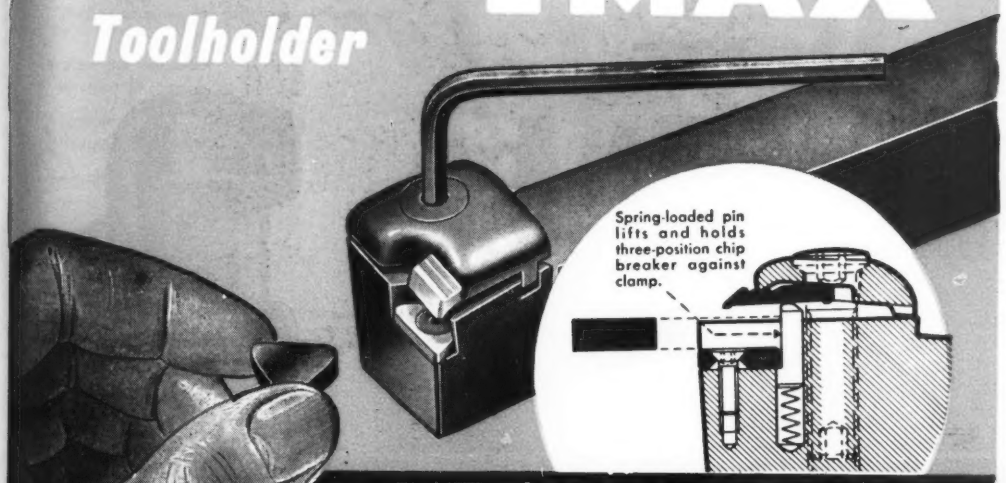

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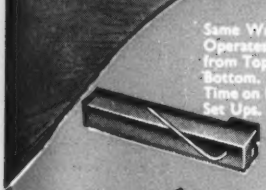
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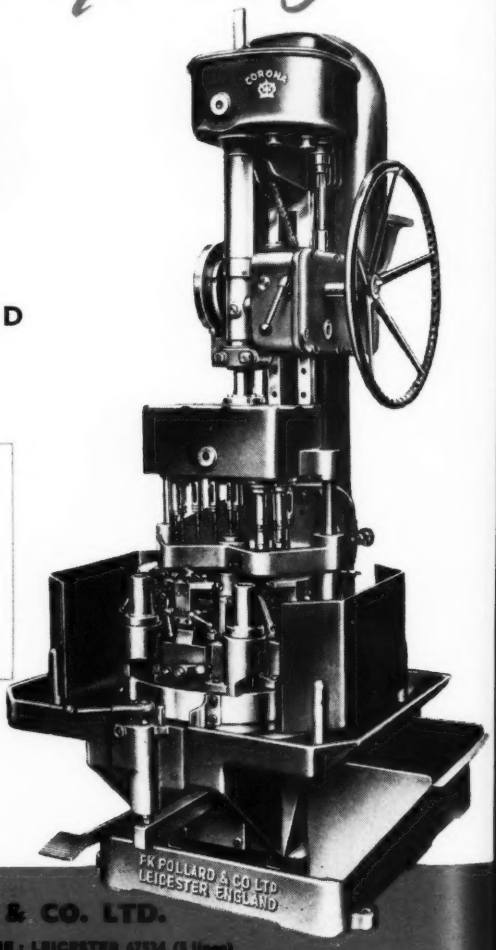

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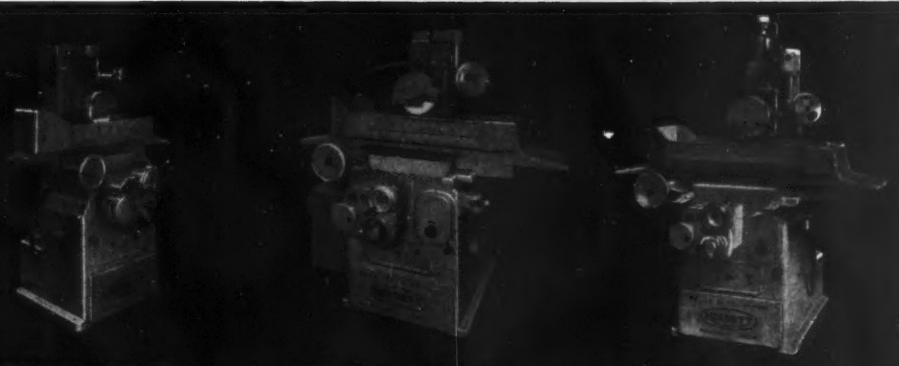

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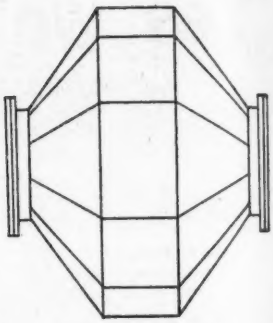

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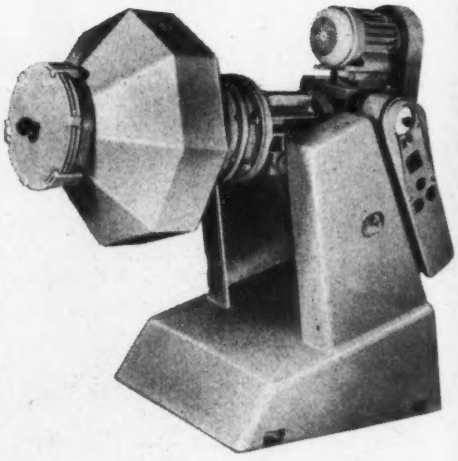

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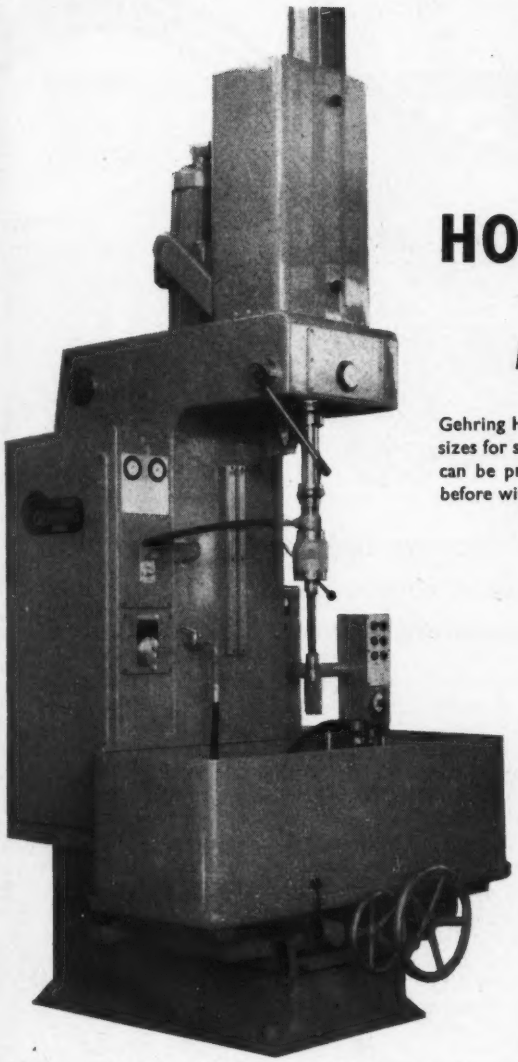

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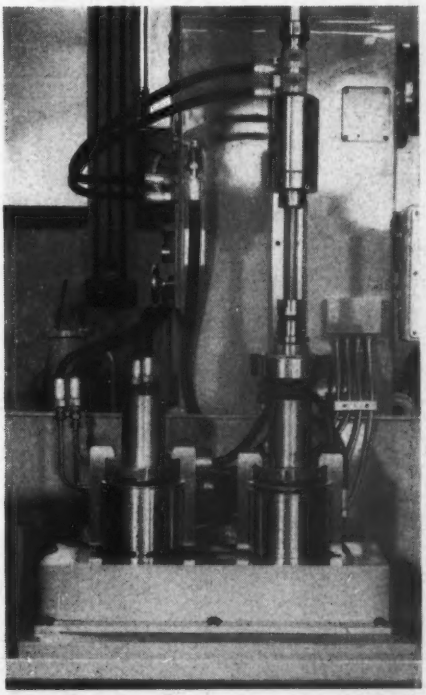

Automatic Two Position Table

The illustration on the right shows an automatic two-position table with automatic liner clamping fixture. Rotary tables and transfer equipment for incorporation as part of a transfer line can also be provided.

Sales and Service for the British Isles

DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

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IF 430

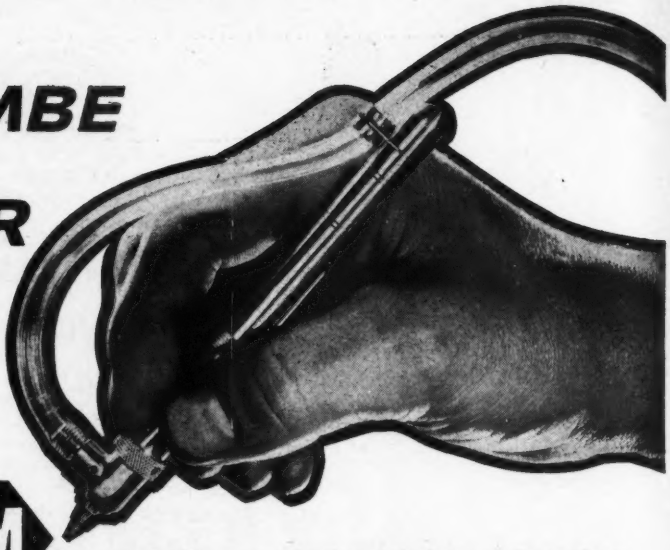
THE

ASHCOMBE

INDUSTRIAL

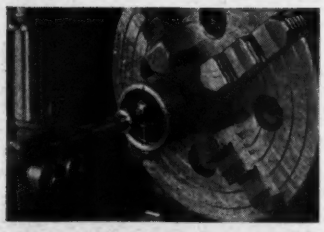
AIROTOR

is here!

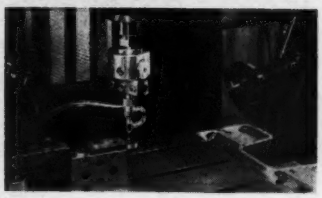


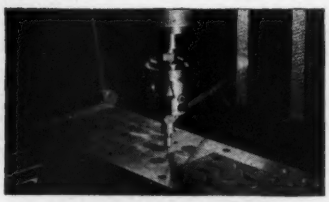
300,000 RPM

A revolutionary industrial tool for ultra high speed removal of metal and other materials to precision tolerances.



The Ashcombe Airotor is an air-driven instrument operating at a spindle speed in excess of 300,000 r.p.m. This speed develops the full efficiency of small carbide burrs in a field never before used or known. It is possible now to machine the very hardest tool steels, carbides, ceramics, chrome, glass, plastics etc. to close tolerances using inexpensive carbide, diamond and abrasive tools. The high operating speed dissipates all heat from the instrument and from the material being worked, and there is no tendency for the burr to 'climb'. The Ashcombe Airotor can be used as a hand tool, or easily adapted for use with Jigborers, Lathes, Milling Machines, Pantographs or in special 'set-ups'. The Airotor head itself is only $\frac{3}{8}$" diameter and $\frac{1}{2}$" long, allowing the instrument to reach into confined spaces and openings. A full range of tungsten carbide burrs and diamond mounted points are available for use with the Ashcombe Airotor, which can be operated from an airline providing a pressure of 40 lbs. p.s.i.





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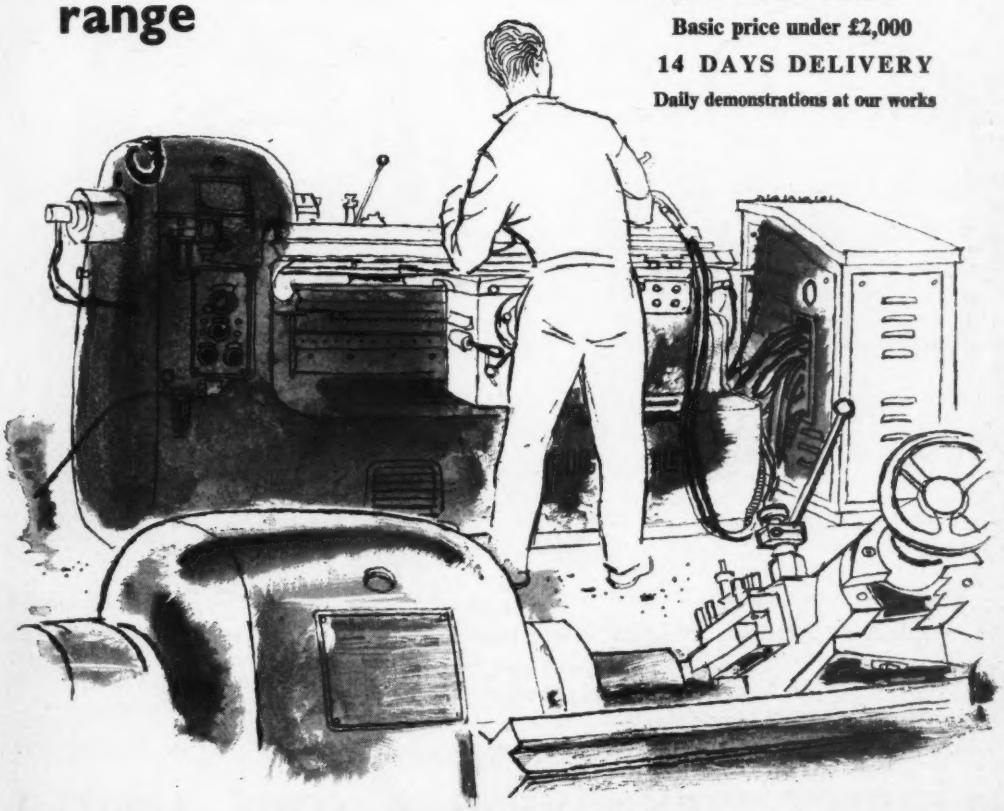

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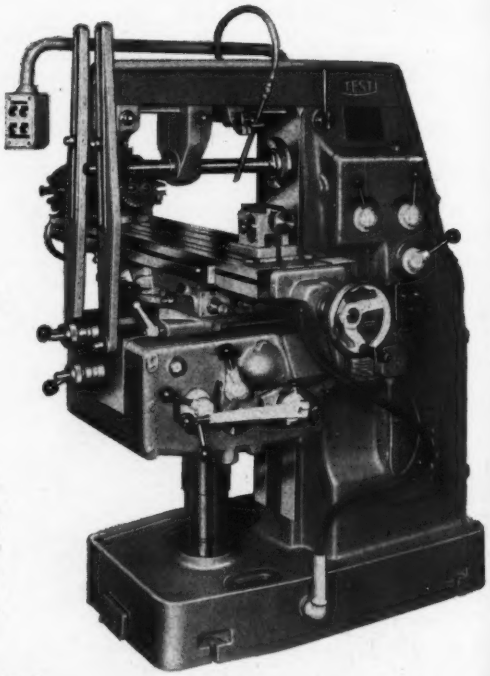

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With these salient features:—

- ★ **Hardened and ground gears**
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- ★ **Speeds up to 2,000 r.p.m.**
- ★ **Electro Magnetic Clutch**
- ★ **Backlash Eliminator**

BRIEF SPECIFICATION

Table:	Working surface ..	48in. by 11in.
Table Feeds:	Longitudinal	29in.
	cross (without brace) ..	9in.
	vertical	17¾in.
Spindle:	Spindle Nose ..	No. 40 N.S.
	18 speeds	40 to 2000 R.P.M.

STANDARD EQUIPMENT—COS-PAR Dividing Head Vertical Milling Attachment Arbor, Front Braces Coolant Equipment etc.

See the whole TEST Range at our works.

Special terms for B.A.M.T.M. Members. **Price £1,825.**

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4 WHEEL COMBINATION CARBIDE TOOL GRINDING AND LAPPING MACHINE

STANDARD EQUIPMENT

Plain Table 9¾in. by 7in.
For rough grinding.

Spring Mounted Adjustable Table 24in. by 9¾in.
The table is arranged to rise and fall and has adjustable inclination with graduated dial. The distance from the table to the grinding wheel is also readily adjustable.

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Fitted to both sides of the work tables.

Twist Drill Grinding Attachment
For left and right hand drills up to ¾ in. diameter.

Radius Grinding Attachment
This attachment is essential for maximum precision and smooth finish on any radius tool. This is especially important when grinding copy turning Tools.

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This hand lever operated attachment is indispensable for precision grinding of chipbreaker grooves in tools of any shape.

Coolant Equipment
Low voltage lighting.

SPECIFICATION

Speed of grinding spindles—r.p.m.	3,300
Height adjustment of table	2¾in.
Inclination of table	0° to 15°
Diameter of Grinding wheels	6in.
Bore of grinding wheels	1in.
Speed of motor—r.p.m.	2,820
H.P. of motor	1½

PRICE £775 · 0 · 0
COMPLETE WITH STANDARD EQUIPMENT

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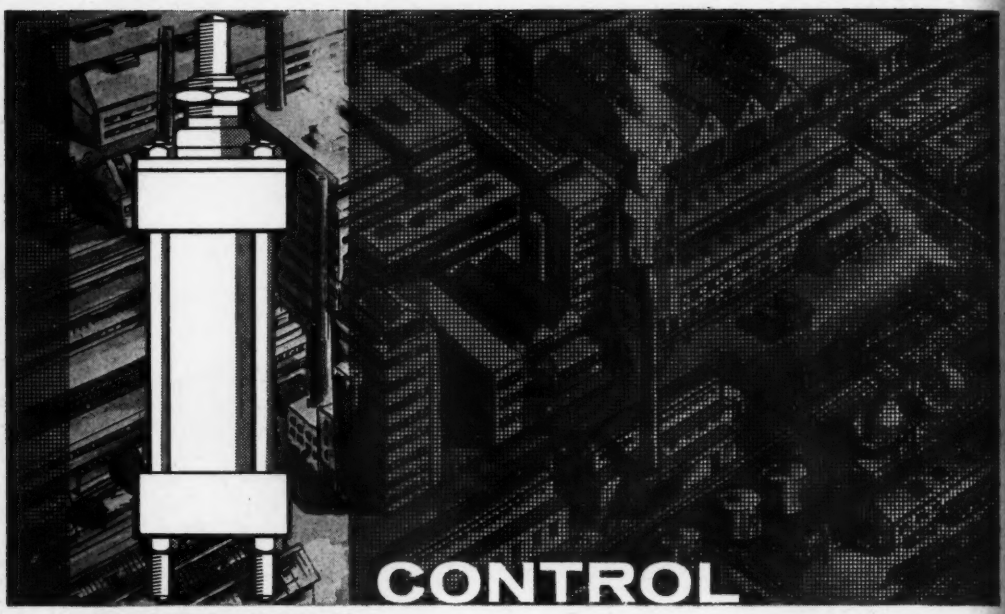
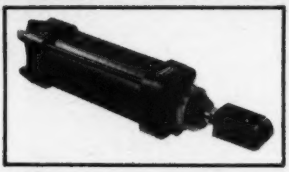
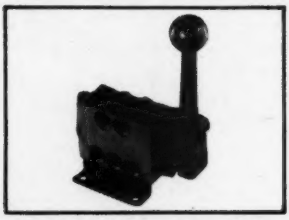


in Industry





Martonair offer three ranges of cylinders—Minor, Standard and Heavy Duty—from ¾" to 12" diameter, and a range of over 400 control valves.

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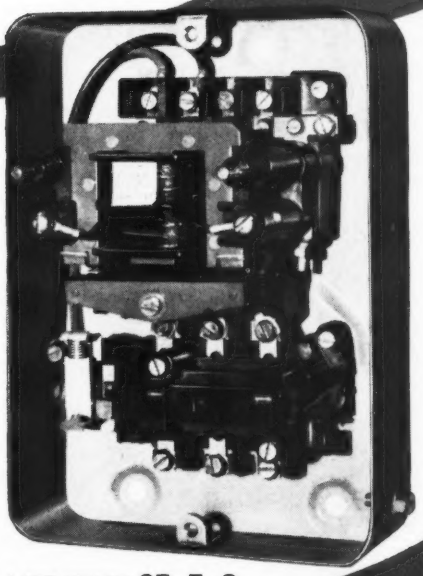
NEW DESIGN FEATURES PLUS

Single-phasing protection *at a new low price*

DOC 80 MOTOR STARTER



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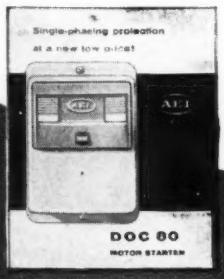

LIST PRICE £5.5.0

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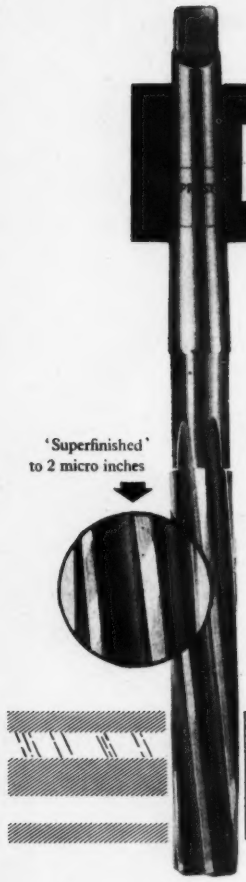
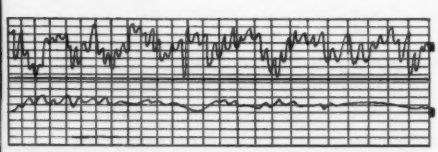


reamers

cost no more ream smoother holes and last longer



Surface finish reading from bore with a standard finish Reamer.

Note improved surface finish obtained from PRESTO 'Superfinish' Reamer.

The cutting lands of PRESTO 'Superfinish' Reamers have a surface finish to 2 micro inches— thus ensuring improved finish in the holes produced and increased tool life through resistance to metal pick-up.' PRESTO 'Superfinish' Reamers are supplied at no extra charge and are available in hand and machine types in sizes 5/16" to 1".

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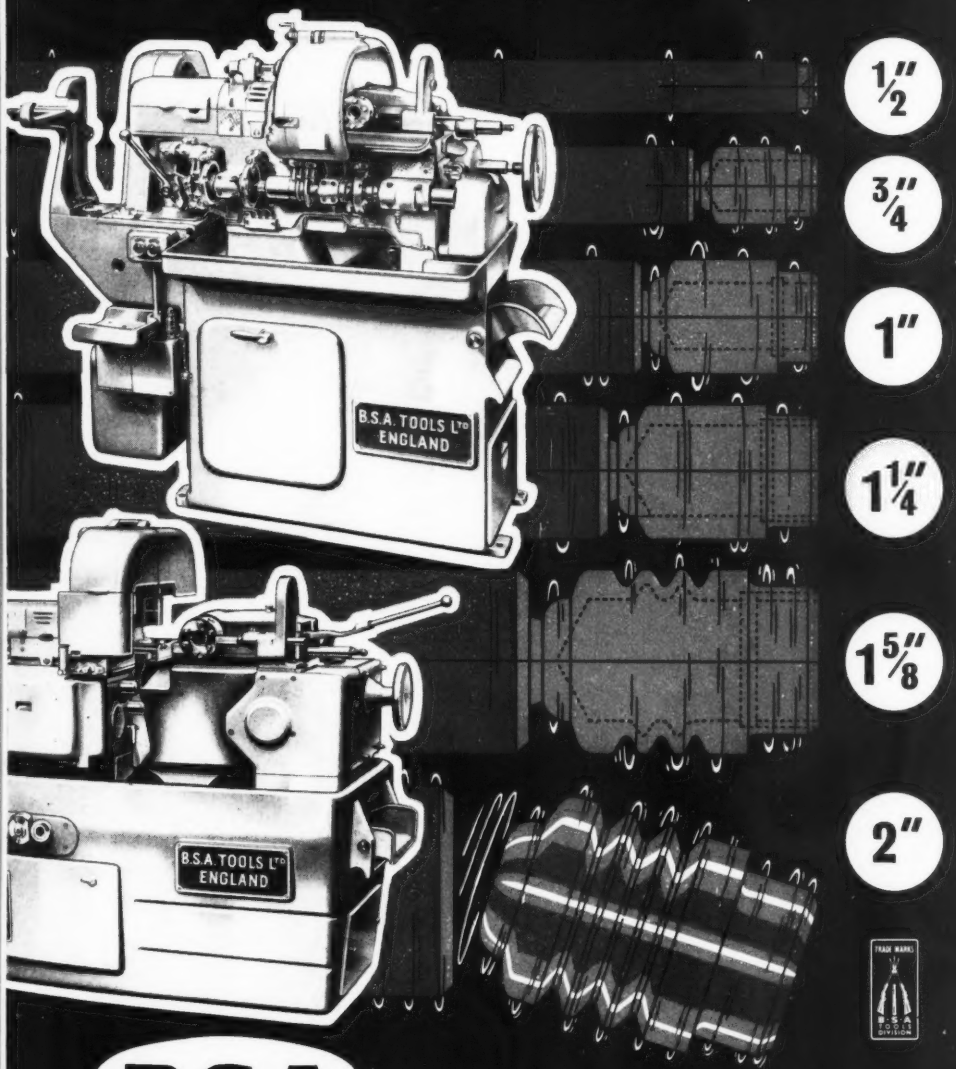

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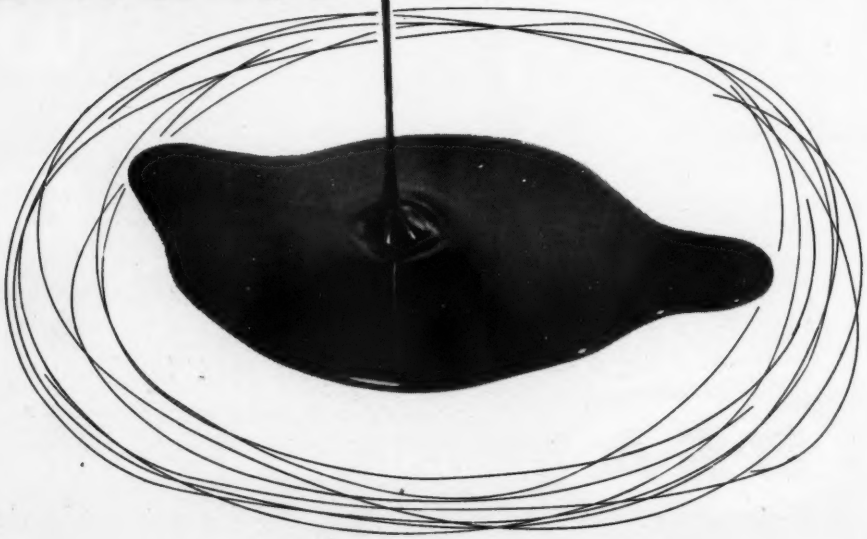

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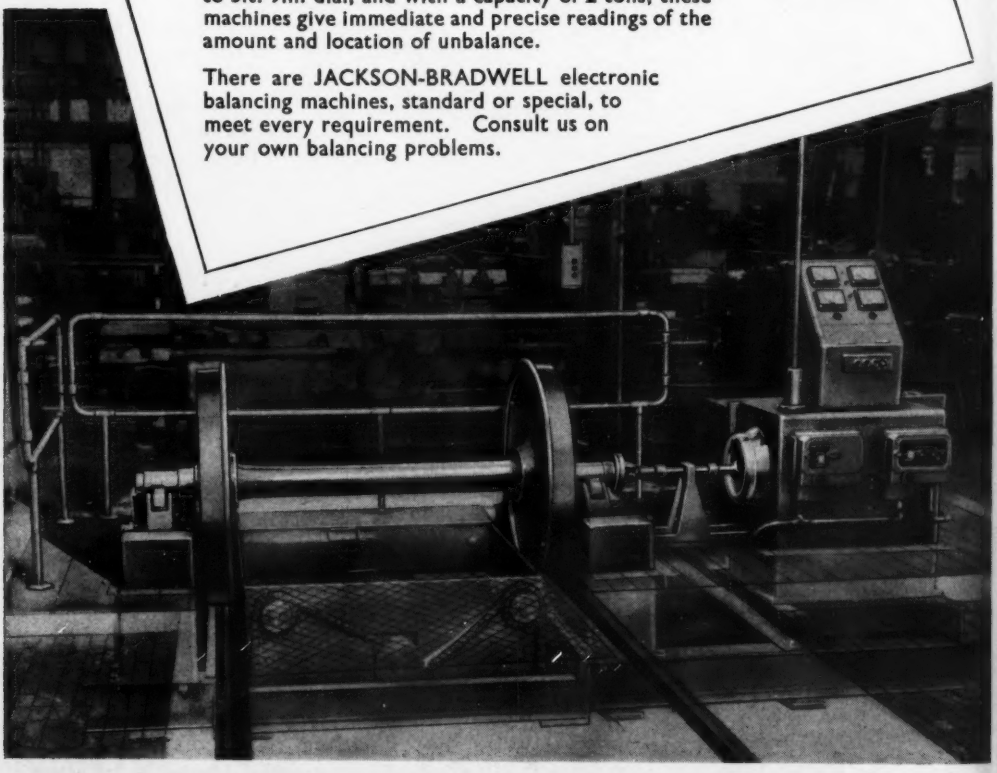

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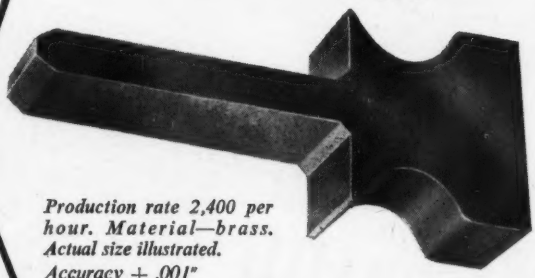

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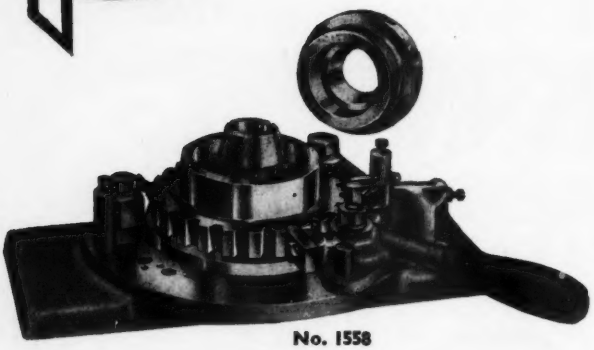

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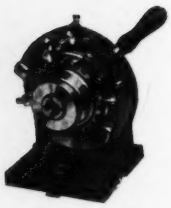

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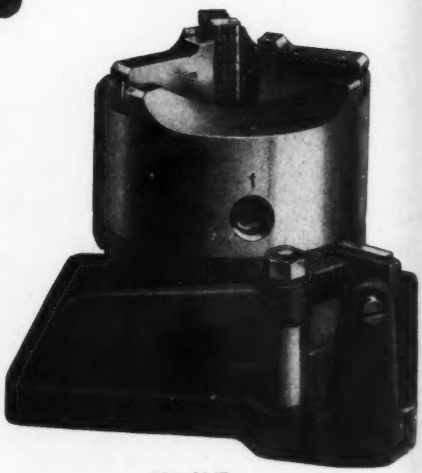
INDEXED BY A SINGLE MOVEMENT OF THE LEVER. INSTANTLY AND RIGIDLY LOCKED IN POSITION BY A RETURN MOVEMENT OF THE LEVER.



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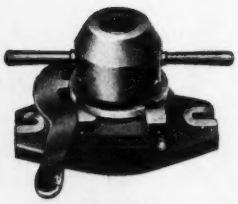

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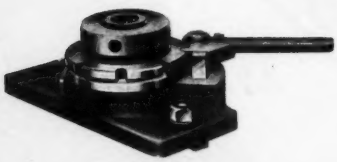

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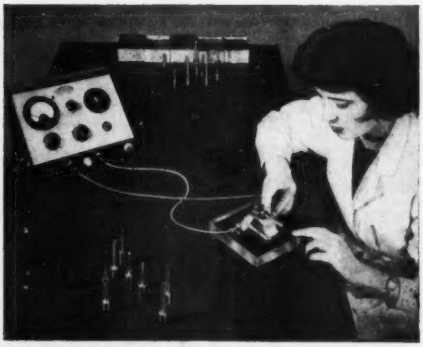
FUNDITOR *Electrolytic Marking Machines*



Marking round parts around circumference using Marking Unit, Model "A" with bench fixture and earthing electrode.

Electrolytic Marking Equipment affords three inexpensive methods of marking metals quickly, permanently and safely without affecting surface structure.

Two models available for surface and deep marking.

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EXTERNAL, INTERNAL AND SURFACE GRINDING ON ONE MACHINE! TO MICRO-INCH FINISHES

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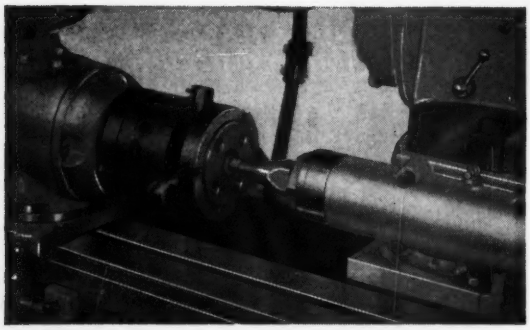
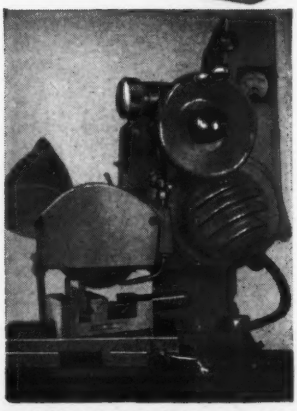


The machine can be rapidly adapted for internal grinding as shown.



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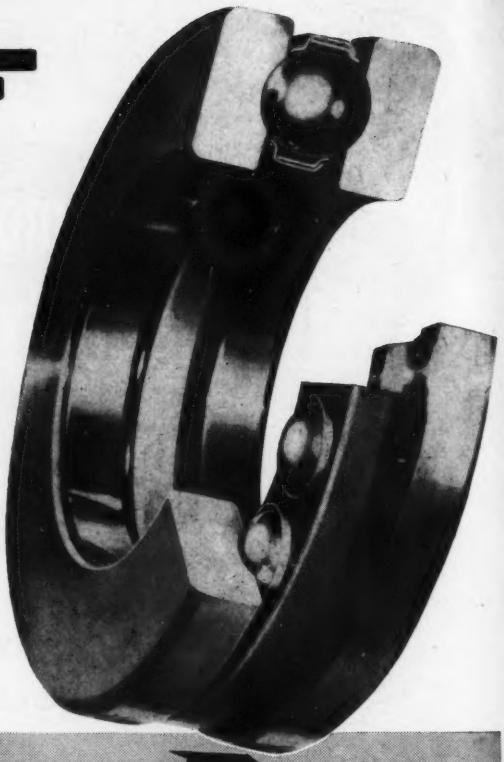

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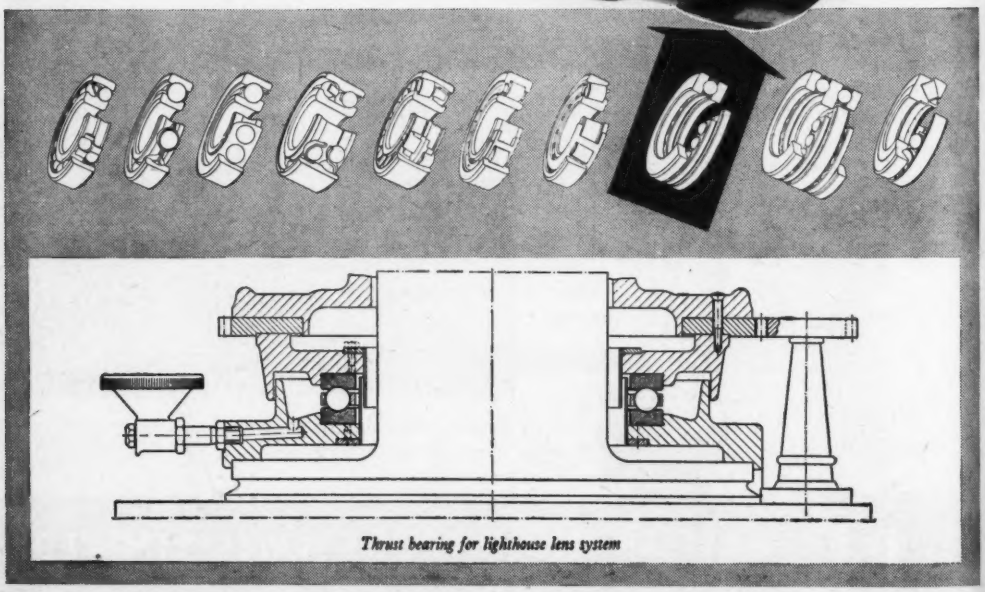

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Abstracts of Principal Articles

The Production of the SIMCA Aronde
P. 696

Under-bodies for Aronde cars are built on a closed-loop line and a parallel conveyor line at the new SIMCA plant at Poissy, France. Front and rear floor panel sub-assemblies, also side members, are delivered to the loading station of the loop line by means of a conveyor, and are mounted in a trolley jig. Loading is carried out at the last station of one side of the loop, and the trolley jig is transferred by conveyor to the track at the other side. This track passes through a series of Languepin multi-point spot-welding machines, also stations that provide for manual spot-welding, assembly of reinforcing pressings to the side members, and loading of internal and external rear wing sub-assemblies. At the end of this track, the trolley jig is returned by conveyor to the first track and passes through stations where manual spot-welding operations are performed to secure the wing sub-assemblies to the under-bodies. Photo-electric arrangements are incorporated at one station to detect whether the under-body is a 2-door or 4-door type, and engage the appropriate clamps. From the unloading station, the partly-finished under-body is conveyed to the parallel line, where spot- and arc-welding is performed to complete the assembly. (MACHINERY, 98—29/3/61.)

Link-line for Machining Steel Valve Bodies
P. 706

Control of the Dowty Roofmaster pit-prop is effected by means of a hydraulic valve, the body for which requires complex drilling boring and reaming operations. Made from steel forgings, these valve bodies are produced at the rate of 300 per week on a 180-ft. line of standard machine tools at the Dowty Exhall Works, Coventry. The machines are linked by transfer rails, and extensive use is made of Dex multi-spindle heads. The forgings are passed along the line on special platens, only two types being required for all the operations. (MACHINERY, 98—29/3/61.)

A Modern Factory for Broach Production
P. 719

At the factory of Forst Broach Co. (Great Britain), Ltd., Dartford Road, Leicester, special heat-treatment equipment, designed and built by the company, in collaboration with A. R. Wade, Ltd., has been installed, for the closely-controlled processes necessary in broach manufacture. Electrical power is supplied by a self-contained plant comprising two 475-h.p. diesel engine/generator units. Special-purpose Forst broach grinding and other machines employed at the factory include spline grinders, throat grinders, flat broach-tooth sharpeners, and climb-milling machines. Reference is also made to a standard 40-ton Forst horizontal broaching machine, which is used for broach testing. (MACHINERY, 98—29/3/61.)

Some Applications of Loose Die Inserts
P. 725

Of the factors likely to affect the production cycle of a die casting machine, the most common is the need to locate inserts in the die at each shot, and in this article the variety of functions which such loose inserts can fulfil and the extent to which they can be used to advantage, despite resulting increases in the nominal durations of the casting cycles, is discussed. The various types of inserts considered include plain and collet, captive, " pill-box," and annular. Examples are also given of the use of loose collars and core plugs, loose cores for heavy casting sections and a magazine-feed arrangement for loading stud inserts. (MACHINERY, 98—29/3/61.)

Churchill Fully-Automatic Production Line for Layshaft Cluster Gears .. P 735

The second fully-automatic machine line has recently been supplied by Churchill Gear Machines, Ltd., Blaydon, Co. Durham, to the British Motor Corporation, for the production of layshaft cluster gears, and incorporates eight Rigidhobbers, five Fellows-England gear shapers (Alfred Herbert, Ltd.), also gear chamfering, tooth rounding, and gear shaving machines, and a Newall cylindrical grinder. There are four Churchill conveyorized washing units, but in contrast to earlier practice, inspection and de-burring of workpieces is carried out by hand. The new line has a capacity for producing 4,500 layshaft cluster gears in 70 hours, from blanks machined from En.351 steel forgings. Separate continuously-moving slat-type conveyors transport blanks between the individual Rigidhobbers, and from one gear shaper to the next in the line, and loading and unloading is carried out by hydraulically-operated units. Layshaft clusters are moved between the other machines by way of inclined guide rails and elevators. (MACHINERY, 98—29/3/61)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

Use of Models in Design

In the design of machine tools it has been customary in the past to rely to a considerable extent on experience, because the diversity of factors affecting performance is such that it has been very difficult, if not impossible, to achieve the desired results on the basis of calculations alone. On the whole, the procedure followed has proved satisfactory enough as is evident from the large number of different machines now available which are noteworthy for outstanding quality. With the growing demands from users for still higher standards of work accuracy and surface finish, however, coupled with capacity for rapid metal removal and a satisfactory degree of durability in service, it appears that a more scientific approach may frequently be desirable in the future. The cost of introducing a radically new design, whether for a standard general-purpose or a special-purpose machine, is rising rapidly, and the ability to predict behaviour reliably at the design stage is consequently assuming continually greater importance. These remarks apply, of course, with particular force to large machines and to intricate special-purpose types for performing multiple operations. In either field, once a machine has been constructed, modification to correct some unexpected functional defect may be impossible or prohibitively expensive.

It appears probable that in the future the designer may be considerably aided by the use of an electronic computer in his efforts to predict the effects of different structural forms on resistance to deflection and vibration under the stresses imposed with widely varying combinations of speeds and feeds, and especially where simultaneous operation of different tools or cutters may result in mutual reactions. Before such an approach could be adopted, however, it is likely that more detailed information on the practical characteristics of existing designs would frequently be necessary, and much is being learned in this respect from measurements of distortion, and vibration frequency and amplitude, under operating conditions.

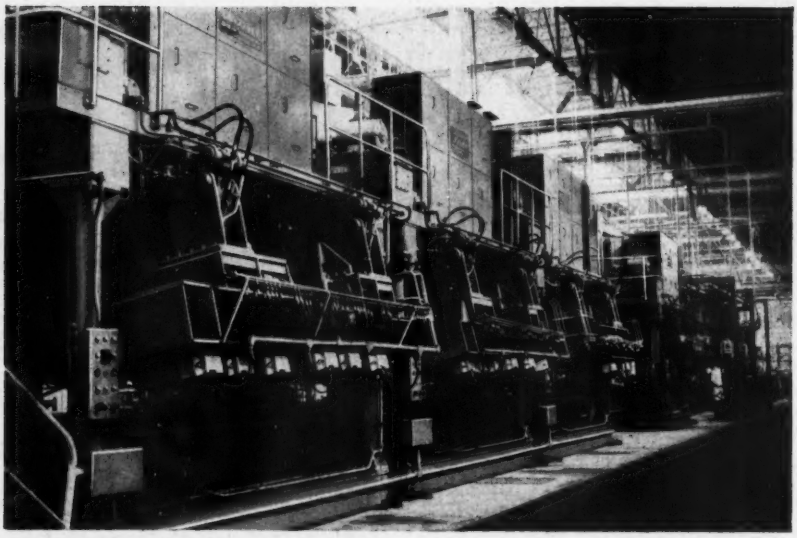
Another method of improving designs, which appears to offer considerable promise, is by the use of models, whereby the characteristics of full-scale machines can be reliably simulated. In certain other fields, this technique is already well established and ample evidence of its value is afforded by the existence of the various elaborate tank and wind tunnel installations, which enable models of ships and aircraft to be realistically tested to determine the suitability of a variety of external forms.

Models of aircraft, in particular, are by no means easy or cheap to produce in view of the strength and accuracy required, especially where supersonic speeds are involved. Construction of machine tool models for design purposes presents very different problems, but here again the cost is necessarily high if they are to serve their purpose effectively. Experience has already shown, however, that knowledge gained in this way may be of great practical value. Apart from such models, moreover, full-scale mock-ups of proposed machines may be made from wood for a quite different—but perhaps no less important—purpose. Such a mock-up affords no information as regards the stability of the machine, but it enables the designer to assess the arrangement of the various controls from the standpoints of operating convenience and avoidance of fatigue. It can thus be ensured that output will not be adversely affected by some inaccessibility that is not readily apparent on the drawing board.

As regards design models proper, it may be recalled that reference was made in MACHINERY, about two years ago, to a somewhat specialized example, which was made in connection with the construction, on the Continent, of a plano-milling machine of exceptional size. This machine has columns of welded steel construction, each weighing 99 tons, and before they were fabricated an elaborate model was made from transparent plastics in order that the arrangement of the internal ribbing could be studied.

More recently our attention has been drawn to work that is being done in this direction at one of the leading private research laboratories in this country, where investigations of problems concerned with machine tool design are an important part of the activities. Here, again, the material employed for machine tool model construction is transparent plastics sheet, and the difficulties of fabrication are accentuated by the fact that it is necessary to simulate cast structures in this medium. These difficulties are, however, being successfully surmounted, and the material offers the advantages that it is easily worked and joined. At the same time it possesses the necessary homogeneity and toughness for the purpose. By making a model of an existing machine and subjecting both to elaborate series of tests it was possible to estab-

(*Continued on page* 744)



The Production of the SIMCA Aronde

Methods and Equipment Employed for the Manufacture of Bodies for this Popular French Car in the New Works at Poissy

By P. A. SIDDERS, Chief Associate Editor

IN THE TWO IMMEDIATELY PRECEDING ARTICLES of this series,* devoted to the production of Aronde cars at the new Poissy factory of the French SIMCA organization, were described the equipment and operations employed for building major sub-assemblies for bodies. These sub-assemblies include front and rear wing units, front and rear floor panels, doors and roofs. Each sub-assembly is built in a section at one side of the main assembly shop, and in each section, the work flows generally across the shop towards the body-building and finishing lines. These lines extend from front to rear of the building, and between them and the sub-assembly sections are a finishing line for roof sub-assemblies, a closed-loop under-body assembly line, whereon front and rear floor panels, and certain other components, are welded together, and an under-body finishing line. Sub-assemblies from the finishing lines for roofs and under-bodies are fed to a second closed-loop assembly line, known as a "berceau," which provides for welding together under-bodies and roofs, also certain other body sub-assemblies.

The under-body spot-welding line is shown diagrammatically in Fig. 1, and it will be seen that there are two parallel tracks, *a* and *b*, which are connected by transverse conveyors *c* and *d* at each end. Trolley jigs circulate on the tracks, and on track *b* pass through a number of multi-point spot-welding machines, indicated at *e*, *f*, *g*, *h* and *j*, which have been built by La Soudure Electrique Languepin, also a number of stations for hand-welding and loading of secondary components. The stations on track *a* provide for further manual spot-welding operations, also for loading and unloading.

There is a total of 25 trolley jigs, of which 24 circulate on the line, and one is maintained in reserve for use in the event of a fault developing

* MACHINERY, 95/252—19/8/59; 95/676—7/10/59; 96/748—6/4/60; 96/860—20/4/60; 96/1036—11/5/60; 97/80—13/7/60; 97/1104—16/11/60; 97/1220—30/11/60; 97/1392—21/12/60; 98/236—1/2/61; and 98/580—15/3/61.

m any jig on the line. This reserve jig is stationed on rails which form an extension of the track *a*, and is indicated at *k*. When required, it can readily be moved on to the main track by way of the rails on the transverse conveyor *d*. Trolley jigs can also be moved from the track *b*, by way of tne conveyor *d*, on to rails that pass through a checking fixture *l*.

Between the reserve trolley jig and the checking fixture is stored a spotting jig for checking the work, as indicated at *m*. The overall length of each track is approximately 230 ft., and the length of the working portion of each, between the transverse conveyors, is 180 ft. Movement of the trolley jigs on each track is effected by hydraulic cylinders, each of which can exert a maximum force of 3 tons, and there are two centralized pump and reservoir units *n* for the supply of pressure oil. Movement of the trolley jigs is controlled by push-buttons at each station of the line, and the operators at all stations must depress their buttons, on completion of their allotted tasks, before the jigs can be advanced to the next station.

WORK LOADING

It may be recalled that sets of under-body main components—each comprising a front floor panel, a rear floor panel, right- and left-hand side-members, and a rear cross-member—are loaded on to special hangers on a conveyor, whereby they are transported from the side of the sub-assembly section to the loading station of the under-body line. This station is seen at *p*, and the conveyor, which is of inverted-U form, is indicated by the lines *r*.

The conveyor is indicated at *R*, in Fig. 2, which shows the loading station with track *a*, Fig. 1, extending into the background. A loaded trolley jig is seen at *S* in Fig. 2, and there is a further set of components on the hanger of the conveyor, ready for loading on to the next trolley jig on the line. Each trolley jig incorporates two mechanical clamping systems. External toggle-type clamps are provided for securing the side-members, and each clamp is operated by a lever that extends outwards from the side of the jig. At the loading station, these levers are foot-operated. The trolley jig also has a central shaft, whereon are fitted levers and links to actuate locating plungers and moving electrodes which serve, in addition, as clamps. This shaft is coupled to—and can be turned by—a transverse sliding member. At one side of the loading station there is a hydraulically-operated pusher, which can be raised by a pedal-operated toggle mechanism, from a position below the steel slat floor of the loading platform. With the mechanism raised, hydraulic power is applied automatically, and the sliding member of the jig is moved transversely, so that the central shaft is turned, and the internal clamps and locating plungers engage the work.

At each operating cycle of the line, a loaded jig is thrust from the loading station on to the rails *T* of the transverse conveyor (*c*, Fig. 1). These rails can slide on guides, *u*, Fig. 1, and *U*, Fig. 2, each guideway comprising a pair of channel-section members. Motion is imparted to the rails by conveyor chains, that pass between the members of each guideway, one such chain being seen at *V*, in Fig. 2. On the two main tracks *a* and *b*, Fig. 1,

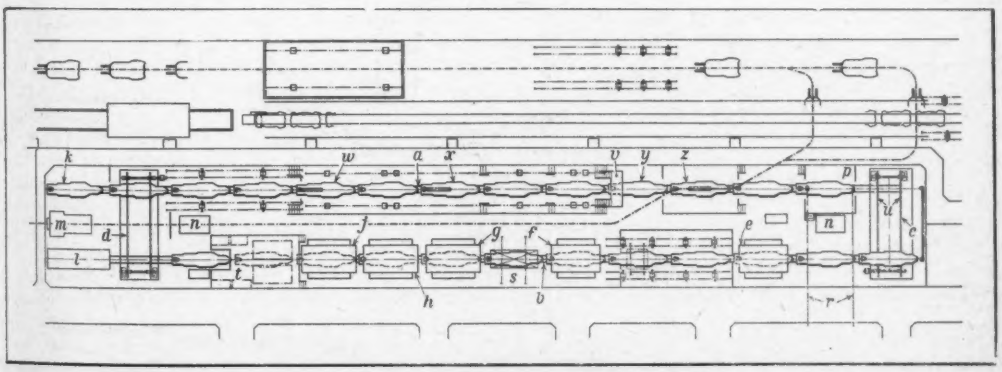


Fig. 1. Plan view of the closed-loop trolley-jig line for building under-bodies for Aronde cars at the SIMCA works at Poissy, France. The finishing lines for under-bodies and roofs are also shown. The loop line comprises two tracks, connected by transverse conveyors at each end and a total of 24 jigs is maintained in circulation. One track passes through five Languepin multi-point spot-welding machines

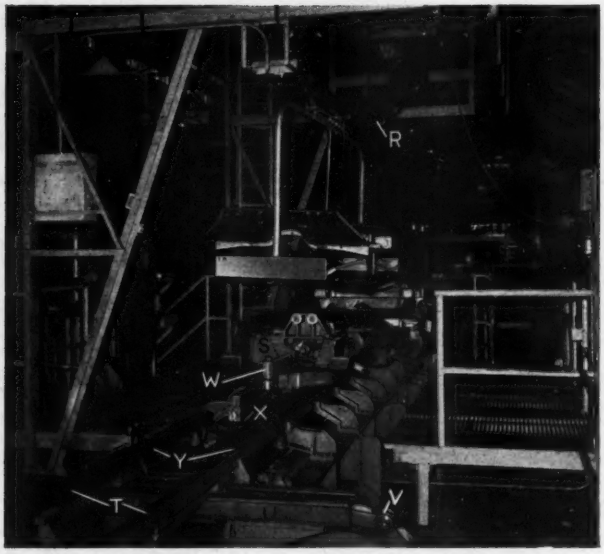


Fig. 2. The loading station of the closed-loop trolley-jig line for building under-bodies. Front and rear floor panels, also right- and left-hand side-members, are delivered to the station by conveyor

the trolley jigs are connected by couplings at either end. The coupling at one end of the jig at the loading station may be seen at *W* in Fig. 2, and it comprises a roller carried on a vertical shaft that projects downwards from a bracket which is bolted to the trolley.

At the other end of the jig there is a transverse member, of rectangular-section, whereon a substantial box-type slide is free to move. This slide has a claw projecting from the rear vertical face, and the arrangement is such that when the slide is moved in one direction, the claw engages the roller of the next trolley jig. Movement of the slide in the other direction results in disconnection of the two jigs.

The slide of the claw coupling projects below the level of the rails of the tracks *a* and *b*, Fig. 1, and at the loading station, a section of the inner rail is arranged to swing inwards, as seen at *X* in Fig. 2. This swinging motion takes place automatically after a trolley jig has been advanced on to

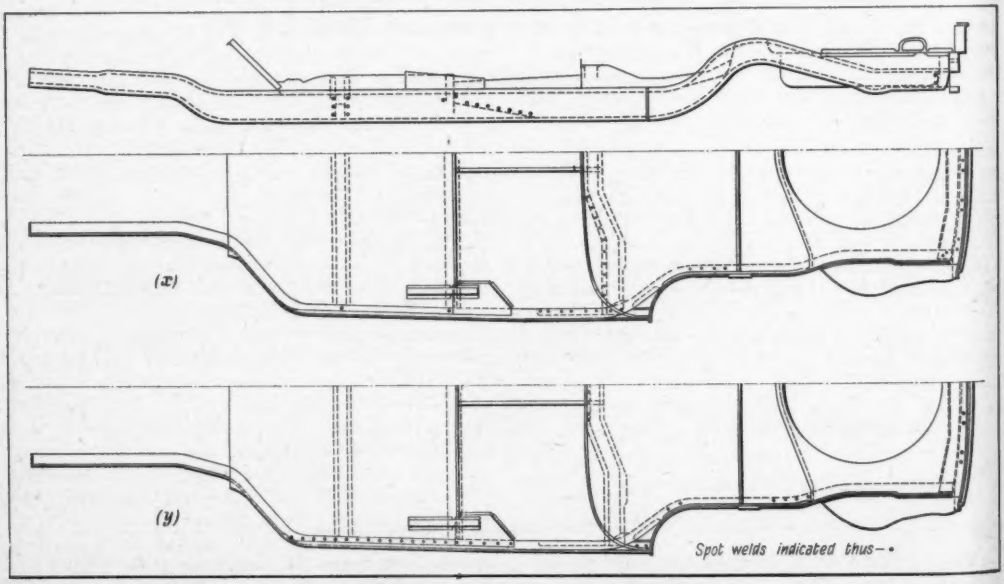


Fig. 3. The spot-welds made on the first Languepin multi-point machine of the under-body loop line are indicated in view (*x*), and those made on the second machine, in view (*y*)

the rails of the transverse conveyor. Movement of the trolley on to the conveyor, and of the swinging section of rail, serve to actuate limit switches, and the conveyor drive is engaged only after both movements have been completed. When the trolley is on the conveyor rails, the roller of the coupling *W* is aligned with a length of steel channel section, supported parallel with the conveyor guideways. As the trolley is transported sideways, the roller of the coupling enters this channel, and the trolley is thus prevented from moving off the rails of the conveyor. It may be mentioned here that, in order to facilitate mating of the rails of the conveyor and main track, the end sections of rail on the main track, as indicated at *Y*, are hinged at one end and supported on a slide at the other, and are swung sideways at the start of the conveyor traverse. Moreover, once the jig is clear of the main track, the swinging section *X* is returned to its original position.

When the transverse conveyor reaches the end of its travel, the trolley jig mounted thereon is automatically coupled to the jig at the starting end of track *b*, Fig. 1. The roller of the coupling at the free end of the jig is then clear of the retaining channel, and the trolley is pulled off the conveyor rails when the whole line of jigs on track *B* is advanced. After the trolley has moved clear of the conveyor, the latter is returned to the position at the end of track *a*. Hinged rail sections, similar to those described, are provided at the starting end of track *b*.

MULTIPLE SPOT-WELDING OPERATION

No work is performed at the first station to which the loaded trolley jig is carried on track *b*, and the jig is moved from this station to the first Languepin machine *e*. This unit provides for making a total of 92 spot-welds, in the positions indicated in view (*x*), Fig. 3, and these welds are completed in four groups.

On each of the Languepin machines, the sections of rail forming part of the track *b*, Fig. 1, are mounted on hydraulic rams, and below the track, in advance of each moving section, there is a sliding member actuated by a hydraulic cylinder. Fig. 4 is a view of one multiple spot-welding machine, and the sliding member and cylinder are indicated at Z and A respectively. After a trolley jig has been advanced on to the moving section of track, the bar is thrust sideways and a dog thereon engages the claw coupling of the adjoining jig and slides it sideways, clear of the roller of the jig in the Languepin machine. The vertical motion of the rams is then engaged, and the track is raised, lifting the trolley jig into engagement

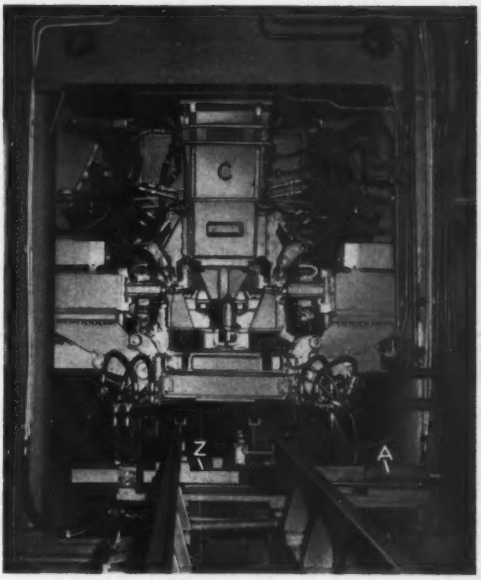


Fig. 4. View of one of the Languepin multi-point spot-welding machines, showing a trolley jig raised to the welding position, on a section of track that is mounted on hydraulic rams

with location pegs and pads, which project downwards from the structure *C*, secured to the crown of the machine. Limit switches are mounted at either side of the machine (also on the others in line) and engage the clamps to check that they have been applied.

The electrodes are mounted on swinging members at each side of the machine, as may be seen in the heading illustration, and with the jig in the raised position, these members are moved inwards. At either end of each member there is a bracket with a hardened pad which engages the frame of the moving section of track, as the members move inwards, and the track and jig are thus locked in the raised setting. At the end of the spot-welding operations, the swinging members carrying the electrodes are withdrawn, the track and jig are lowered, and the jig is advanced to the next station in the line, at the start of the following operation cycle.

This station is one of two, seen in Fig. 5, which are situated between the first and second multi-point spot welding machines. A series of manual spot-welding operations is carried out on each under-body by operators at either side of the line. The pincer-type spot-welding tools employed are

suspended from overhead rails, which also support the transformers, and it may be mentioned that the photograph for Fig. 5 was taken before the installation had been completed, a steel-slat platform now being provided for the operators. The work carried out at these stations includes the assembly and welding of seat supports, also a reinforcing bracket, to each side member, adjacent to the rear floor panel, and the under-body is then advanced to the second Languepin machine *f*, Fig. 1. Welds are produced by this machine at the positions indicated in view (*y*) Fig. 3, a total of 74 being made, in four groups.

From the second multi-point welding machine, the under-body is moved to the station *s*, Fig. 1, where reinforcing members are assembled to each side member of the under-body. The assembly station is seen in Fig. 6, and the reinforcing members are stacked on a tubular frame *D*, which can be traversed on rails *E*. These rails are indicated by double-chain line in Fig. 1, and extend from the assembly station to a loading position on the gangway that separates the under-body line from the sub-assembly sections. Reinforcing members are delivered to this position by trolley, and when loaded on the frame *D*, are accessible to operators at both sides of the assembly station. Support blocks are fitted to the ends of the side members of the under-body to prevent them from being crushed during the next multi-point spot welding operation. The reinforcing members are held in position by clamps at each side of the trolley jig, and the members at the front end of the under-body are tack-welded in place by a second operator at each side of the line, who uses hand-held pincer-type equipment.

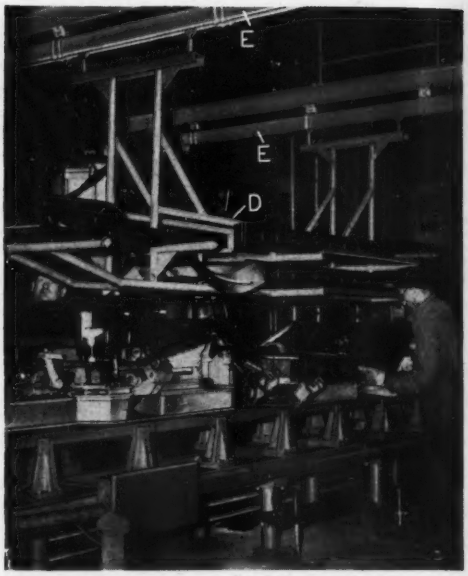


Fig. 6. Reinforcing pieces for the side members of under-bodies are delivered to this station, beyond the second Languepin machine

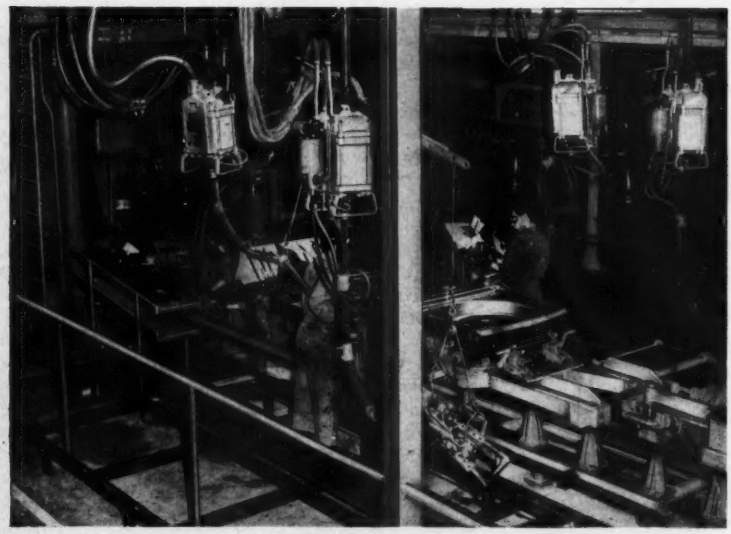


Fig. 5. These stations between the first and second Languepin multi-point spot-welding machines provides for the assembly of certain secondary pressings, and hand-welding them in position

The reinforcing members are spot-welded to secure them to the under-body side members by the group of Languepin machines indicated at *g*, *h* and *j* in Fig. 1, and this group of machines is seen nearest to the camera in the heading illustration. Again, the trolley jigs are lifted by hydraulic

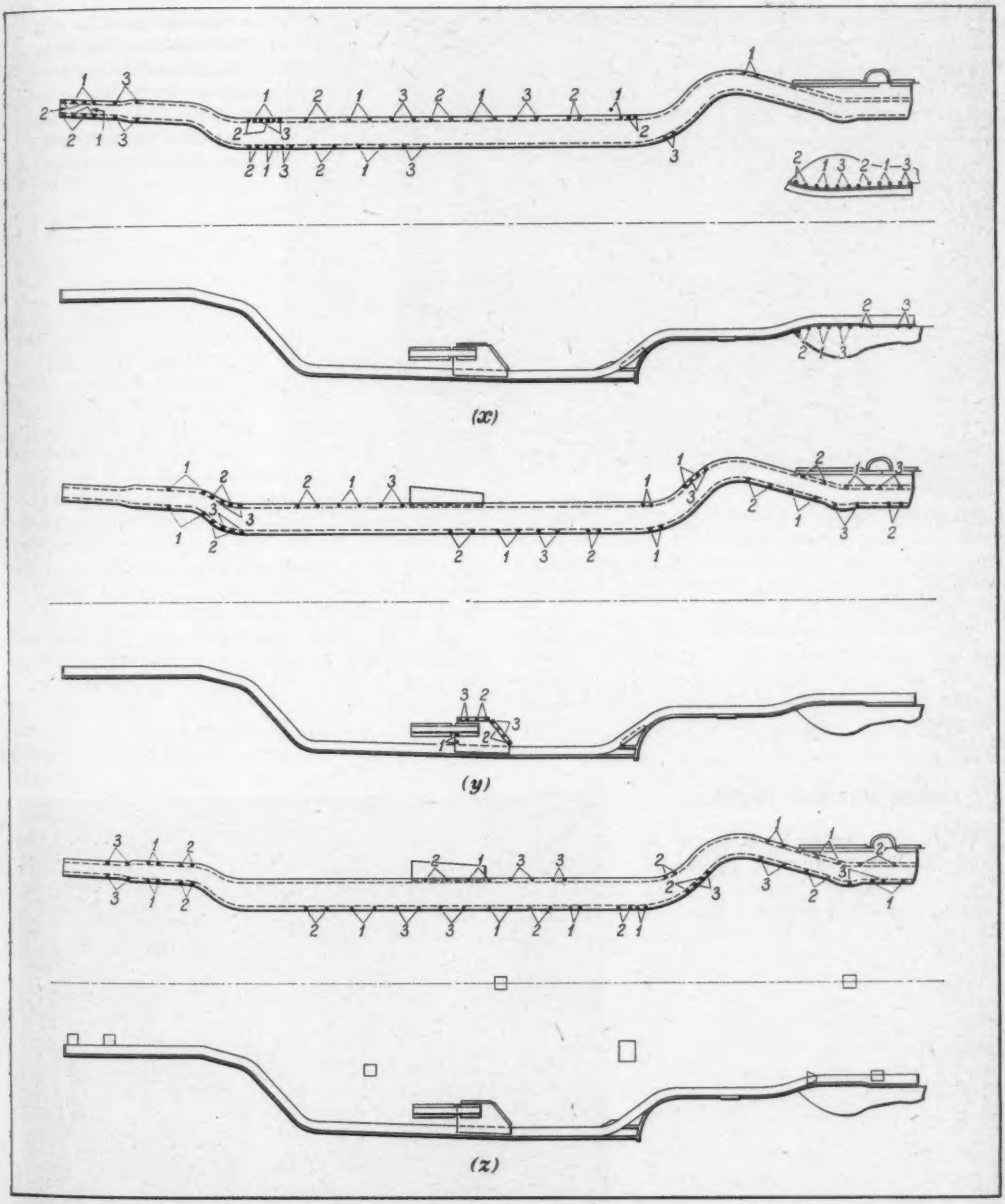


Fig. 7. Diagrammatic side-elevation and half-plan views of the under-body sub-assemblies for SIMCA Aronde cars. Spot-welds produced by the third, fourth, and fifth Languepin multi-point machines on the closed-loop line are shown in views (*x*), (*y*) and (*z*), respectively. The series method of spot-welding is employed, and on each machine the welds are made in three groups as indicated

Fig. 8. View from the bridge at the end of one side of the under-body loop line, looking towards the transverse conveyor for movement of the trolley jigs to the other side of the loop. From the bridge, inner and outer rear wing sub-assemblies are placed on the jigs

rams into engagement with location pins and pads in the superstructures of the machines, and the welding electrodes are carried on support members that are swung inwards from each side of the machines.

Spot-welds are produced in pairs by the series method, as indicated in views (*x*), (*y*) and (*z*), Fig. 7, and are completed in three groups, as indicated in the figure. A total of 124 spot welds is made on machine *g*, and 116 on each of the machines *h* and *j*.

LOADING REAR WING ASSEMBLIES

When each trolley jig is moved on from the fifth multi-point machine *j*, Fig. 1, it passes through an idle station, beneath a bridge structure *t*. This structure is of bifurcated form at one end, to afford access to the trolley jig when it reaches the last station of the track *b*. Outer rear wing assemblies are delivered to the bridge structure on wheeled racks, by way of the gangway at one side and a monorail hoist. Storage areas for wing assemblies for 2- and 4-door cars are indicated by chain-dotted line, at the right on the bridge in Fig. 1, and there is accommodation for five racks for 2-door and six racks for 4-door units. The corresponding inner rear wing assemblies are stored in the positions indicated by chain-dotted line at the left of the bridge. While each jig is in the station at the end of the line, operators on the bridge place one outer wing assembly and two inner wing assemblies on the under-body, and these assemblies travel with it to the hand-welding stations on track *a*.

Fig. 8 is a view from the bridge structure, and an under-body is seen at *F* at the last station of the track *b*, with a rear wing outer assembly at *G*. The under-body assembly at *H* is on the rails of the transverse conveyor *d*, Fig. 1, ready for transfer to the track *a*. This conveyor is of similar design

Fig. 9. View of the second side of the under-body loop line, which provides for assembly and manual spot-welding of the inner and outer rear wing assemblies

Fig. 10. Hydraulically-operated swinging members at either side of the track carry clamp units that hold the inner rear wing assemblies in position while they are tack-welded to the under-body

to that already described, and the twin guideways, whereon the rails and trolley jig are moved transversely, are indicated at *J* in Fig. 8. Beyond them may be seen a guide channel, which is engaged by a roller on the trolley, at the same end as the claw coupling, to retain the trolley on the conveyor as it is traversed sideways.

There are 11 stations on the track *a*, Fig. 1, one of which provides for loading, as already described, and another for unloading the completely welded under-bodies. In advance of each of these stations is an idle station, and the remaining seven stations, extending along the track from the transverse conveyor, are employed for further spot-welding and assembly operations. Hand-held spot-welding tools, and the associated transformers, are suspended from an overhead framework at each side of the track, and at the first two stations, the operators work from steel-slat platforms that are just above floor level. These stations provide for finishing the welding of the assemblies as delivered from the last Languepin machine.

At the next five stations, the operators work from raised platforms at either side of the line, and there is a bridge *v* connecting the platforms at the end adjacent to the unloading station, a view of the line from this bridge being given in Fig. 9. Inner rear wing assemblies—placed on the under-body assemblies at the end of track *b*, Fig. 1—are located and clamped in position at station *w*, and are welded to the under-body at this and the succeeding stations. Fig. 10 is a view of a trolley jig at station *w*, and at either side of the track there are auxiliary clamping units, as at *K*, which are mounted on arms that can be swung inwards by hydraulic power. At this station, and others on the line where auxiliary clamping and locating units are employed, the trolley jig is supported on a length of track that can be raised or lowered on hydraulic rams, to a predetermined height, to ensure accurate alignment of the jig and the auxiliary units.

The auxiliary units at station *w* provide for clamping inner wing assemblies of two types, for 2-door and 4-door cars, and each has a beam with locating and clamping members at each end. At one end, the locating arrangements incorporate a sliding pin that engages a pierced hole in the wing pressing, and at the other end, there is a form-block which is embraced by the pressing. In Fig. 10, the auxiliary unit is seen swung clear of the trolley jig, in readiness for movement of the jig to the next station. Spot welding is carried out with the aid of the equipment at *L*, which has a stirrup-shaped frame, of weld fabricated construction. A cranked electrode *M* is fixed at the end of one arm of the frame, and an electrode assembly *N* is pivotally mounted at the end of the other arm. With the electrode *N* in the position shown, the frame can be positioned over the rear wing and under-body assembly, with the fixed electrode on the inside. The electrode assembly *N* can then be swung to a position at 90 deg. to the arm of the frame, by a pneumatic cylinder *P* within the arm, and is held in this setting. A second cylinder in the assembly urges the electrode into contact with the work for making the spot-welds, and both cylinders are controlled by valves mounted on the side of the frame.

Rear wing outer assemblies (each incorporating a luggage boot cross-member) which were placed

on the trolley jig at the end of track *b*, Fig. 1, are mounted in position on the under-body at station *x*, and tack-welded in place. A temporary cover is also tack-welded to the under-body to close the opening in the front panel that gives access to the gearbox, and this cover is removed after the bodies have been painted. The trolley jig is then moved to the next station, where it is lowered on hydraulic rams, and the rear wing assembly is engaged by clamping and locating units that are carried on swinging arms at either side.

These units may be seen in Fig. 11, and the arms are moved inwards by hydraulic cylinders. Clamping units are provided to hold rear wing outer assemblies for both 2-door and 4-door cars, and in the illustration, the clamps for the 4-door type are not in use and remain clear of the work, as seen at *R*, since an under-body for a 2-door car is mounted on the trolley jig. Clamps as at *S*, which incorporate tongues that engage the gutter round the luggage boot opening, are employed for both types of assemblies. The clamp units for 2-door and 4-door assemblies are selected automatically, and photo-electric equipment is provided at the station to detect which type of assembly is loaded in the trolley jig.

The rear wing outer assembly is tack-welded in position at the mounting station (*x*, Fig. 1), and welding is completed at the two following stations, using hand-held tools. After passing through the idle station *y*, the trolley jig reaches the unloading station *z*, Fig. 1, which is shown in Fig. 12. At this station, the trolley jig is located beneath a drop-section *T*, of an overhead "power-and-free" conveyor, which is indicated by chain-dotted line in Fig. 1. The drop-section is coupled to a long-stroke air cylinder, and incorporates a pair of channel-section rails, which are aligned with the corresponding rails forming the main track of the conveyor, when the drop section is raised to the full extent. Hangers of the type seen at *U* in the illustration are moved along the main track by dogs on a chain that runs on an upper rail, of joist section.

At a point just in advance of the drop section, the upper rail curves to one side of the main track, and then runs parallel to it, finally swinging back above the main track as seen at *V*. In consequence, drive to the hangers of the conveyor ceases just in advance of the drop section, on to which they are carried by their momentum. Once a hanger has moved fully on to the drop section, it is secured automatically. Vertical movement of the drop section is controlled by the loading operator, from a pendant panel, and the section is seen in the fully-lowered position.

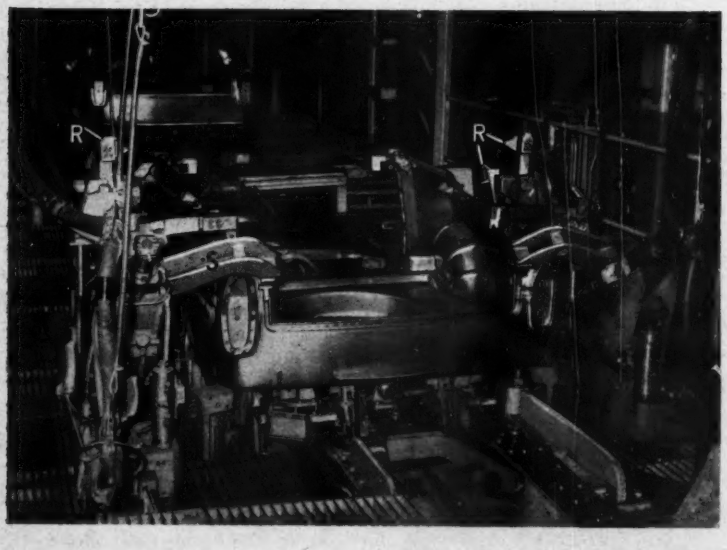


Fig. 11. A view of the station for spot-welding outer rear wing sub-assemblies to under-bodies, showing the clamping arrangements at either side of the track. Photo-electric equipment is installed to detect whether the sub-assembly is for a 2- or 4-door car, and to select the appropriate clamps

At the unloading station, there is a hydraulically operated ram that moves the transversely-sliding member of the trolley jig, whereby the internal clamps are actuated, as already explained in connection with the loading arrangements. Other hydraulic rams, at either side of the track, engage the operating levers of the external clamps, and move these units clear of the work. With the work unclamped, two rams beneath the track are moved upwards and pass through the trolley jig, to lift the under-body assembly clear of the jig seatings, and into a position where it can be secured to the hanger on the drop section.

The hanger has a tubular bridge-member

W, of shallow U-form, which is pivotally mounted at either end of the stirrup-shaped main frame. This bridge-member can be secured in two positions, at 90 deg. apart, by means of a sliding pin, actuated by the lever *X*, which enters holes in a disc. At the front end of the bridge-member there is a cross-bar, which has pegs to engage the front ends of the side-members of the under-body. On a second cross-bar, at the rear end of the bridge member, brackets, as at *Y*, can slide. Each bracket carries a cone-ended peg, and the brackets can be moved outwards, from the position shown, by means of the lever *Z*, so that the pegs enter pierced holes in the side members, at the rear end of the under-body. With the under-body secured to the hanger, the drop section is raised, and the operator pushes the hanger on to the main conveyor track, and along the track to a position where it is again engaged by the moving chain.

UNDER-BODY FINISHING LINE

On the overhead conveyor, the under-bodies are carried to a finishing line that extends parallel to the closed-loop line just described, but is separated from it by the finishing line for roof sub-assemblies, as may be seen in Fig. 1. Under-bodies travel along the finishing line mounted on the hangers, and are inverted where necessary to suit the operations to be performed. At the first station of the finishing line, hexagon-head screws are fitted in the tapped holes of certain members of the assembly to protect the threads during the subsequent painting operations. Under-bodies next pass through a series of stations where spot-welding operations are performed, and then through sections for arc and oxy-acetylene welding.

At the end of the finishing line, the conveyor rises, and the hangers carrying the completed under-bodies pass on to a gravity-feed run of conveyor, whereby they are delivered to a drop section that serves the "berceau" (or closed-loop trolley-jig line) for the assembly of under-bodies and roofs. Hangers are held on the gravity-feed conveyor, and are released automatically, one at a time, to the drop section. Vertical movement of the drop section is controlled by an operator who also releases each under-body from its hanger on to a special trolley, that runs on rails let into the floor. Once the under-body has been unloaded, the drop-section is raised by the operator, and the hanger moves on to a continuation of the gravity feed conveyor, when the drop section has been returned to its original position. The continuation of the gravity feed conveyor curves through 90 deg. and connects with the feeding chain whereby the empty hangers are moved to the unloading

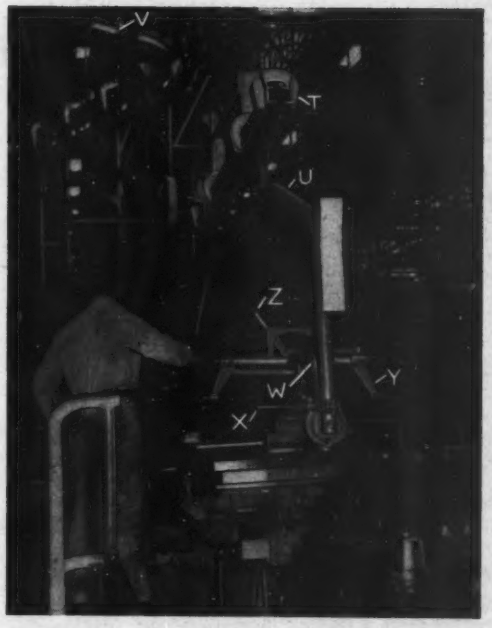


Fig. 12. In this view of the unloading station of the under-body loop line, may be seen one of the special hangers on the drop-section of a conveyor serving the finishing line

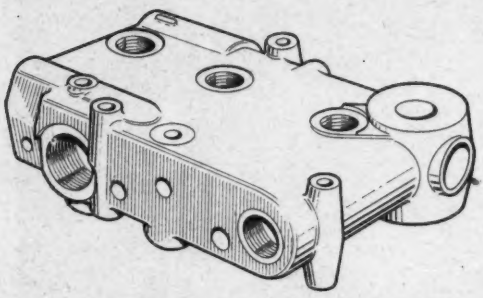
station of the loop-line for under-body assembly.

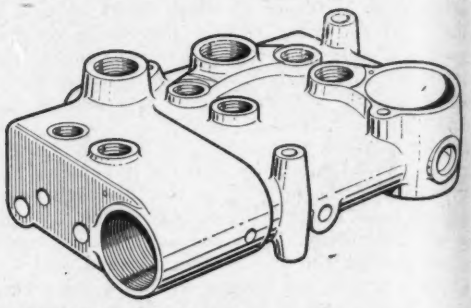
The special trolleys whereon the under-bodies are loaded also receive roof sub-assemblies from the roof finishing line, and serve for moving pairs of sub-assemblies to pick-up positions for two overhead travelling hoists whereby the sub-assemblies are delivered to stations on opposite sides of the berceau. A third overhead hoist is provided for lifting the assemblies to a storage bank, on a platform above the berceau, if necessary.

Operations on the berceau, and finishing operations on body shells, will be considered in a further article in this series, to be published shortly.

SOLVOSIL SILICONE AEROSOL release agent which has been introduced by Solvolene Lubricants, Ltd., Reginald Square, London, S.E.8, is intended for use in the manufacture of moulded plastics and rubber components, lamp bulbs, and batteries, for example. It is stated that one application suffices for several production cycles and that clean mould surfaces are ensured.

Link-line for Machining Steel Valve Bodies





Details of an In-line Installation of Standard Machine Tools, and Designex (Coventry), Ltd., Multi-drilling Equipment and Fixtures, for Producing Dowty Roofmaster Pit-prop Control Valves at the Dowty Exhall Works

By A. W. ASTROP, Associate Editor

DOWTY HYDRAULIC PIT-PROPS were first introduced into British mines in 1946, and have since been accepted at a rapidly increasing rate. Hydraulically-operated, mobile and re-usuable roof supports have a number of advantages to offer compared with traditional wooden pit-props, which are permanently wedged in position, and cannot, as a rule, be moved or salvaged once installed. To date more than two million Dowty props have been supplied to coalfields in Great Britain and overseas.

Hydraulic mining equipment is developed by Dowty Mining Equipment, Ltd., Ashchurch, Gloucester (a member company of the Dowty Group) and the latest unit to be made available is the Roofmaster, of which there are two basic versions. These units are combined to provide a complete hydraulically-operated roof support system, up to 180 yd. long, and are intended for use in conjunction with a mechanized coal conveyor. The units are of the 2- and 3-prop type, installed alternately and at right-angles to the run of the conveyor, and are connected to the latter by means of hydraulic jacks. On each Roofmaster there is a heavy steel roof beam, supported by either two or three props, and these beams are arranged to overhang the conveyor and provide support for the roof immediately above. A perspective view of part of a typical installation is shown in Fig. 1, where the arrangement of 2- and 3-prop units, alternately, can be seen, and the run of the conveyor is also indicated.

Hydraulic oil under pressure is delivered and exhausted by way of armoured hoses attached to one side of the conveyor, and extending for the complete length, as indicated at *A* and *B*, connections being made to the prop units as required. The hydraulic jack connection between each prop unit and the conveyor is shown at *C*, and oil is supplied to this jack by way of a valve, as at *D*. The arrangement is such that when a lengthwise cut has been made in the seam, the conveyor can be moved transversely—by approximately the width of the cut—to take up a position to receive coal from the next pass. In practice, the jacks are used individually, so that the conveyor is "snaked" into position, and is not moved bodily as a complete unit. After the jack has been extended, to snake the conveyor at any one point, the vertical props of that particular unit are relieved slightly, to lower the roof beam. Next, pressure oil is directed to the opposite end of the jack, with the result that the complete prop unit is drawn towards the conveyor, thereby advancing the roof beam. Oil is then readmitted to the vertical props, and the beam is raised until it is again in contact with the roof.

It will be appreciated that with this system the complete installation of roof supports and coal conveyor can be advanced progressively into the seam as cutting continues, and never more than two props are relieved from the roof at any one time. Raising and lowering of the vertical props is under the control of an operator, and it is stated that only three men are required for the manipulation of the props of a complete installation. Each Roofmaster

has a main control valve, housed within the cover *E*, and this unit is operated by the handle *F*. A non-return valve is incorporated to ensure that the prop remains in the erected position should there be a failure in the mains supply of hydraulic oil.

The control valve beneath the cover *E* is of complex design, and two perspective views are shown in the heading illustration. Made from a forging of En.3a or En.3b steel, this valve block measures approximately 9⅞ by 6½ by 3⅝ in., and weighs about 35 lb. in the as-forged condition. It has a large number of machined holes, some of which are required to be within close limits for size, straightness, and finish, many spot-faces, counterbores, seatings, and shoulders of different types, and numerous internal threads of different sizes, pitches, and depths.

A special production line for bodies for these control valves has been laid down in a new factory situated at Exhall, about 4 miles from Coventry, which has recently been acquired by the Dowty Group. Built on a 14-acre site, the factory has a floor area of 110,000 sq. ft., and is in course of being equipped and laid out for the quantity production of a number of components for the complete range of Dowty hydraulic and mining equipment. It is estimated that more than 1,000 people will eventually be employed at the Exhall factory, which is destined to become one of the most important production plants in the Group.

Several high-production lines are already in operation at the works, and all are of the continuous in-line type, with work flowing uninterruptedly from one end to the other, without any diversions or loops. Of the lines at present in operation, that for the Roofmaster valve body is of particular interest because it is built-up almost entirely from standard machine tools which are linked by simple rail-type transfer equipment. The bodies are progressed along the line on platens —only two different types being required for all the operations—and gravity roller conveyor systems at the rear of the line provide for returning the empty platens to the starting points.

A diagrammatic plan of the 180-ft. production line (not to scale) is shown in Fig. 2, where it will be seen that the majority of the units employed are Kitchen & Wade vertical drilling machines. These machines are of the 21- and 28-in. sizes, and are fitted with Dex multi-spindle heads, of which further mention is made below. Also incorporated in the line are three Ward No. 7 capstan lathes, two Cincinnati vertical milling machines, a Richmond radial drilling machine, and a number of

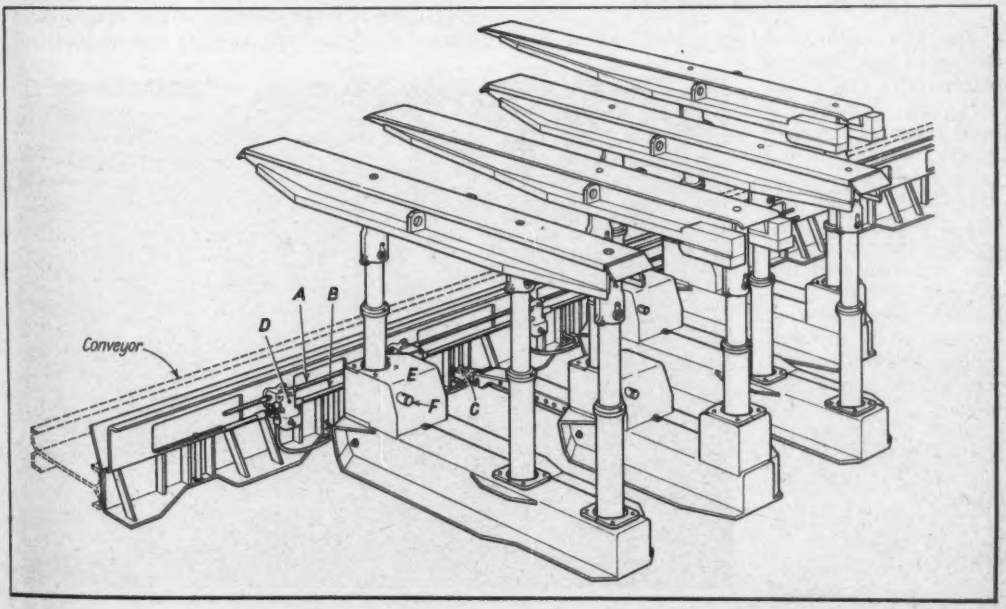


Fig. 1. Part of a typical installation of Dowty Roofmaster hydraulic pit props. The main control valve, whereby oil is admitted to the vertical props, is housed beneath the cover *E*

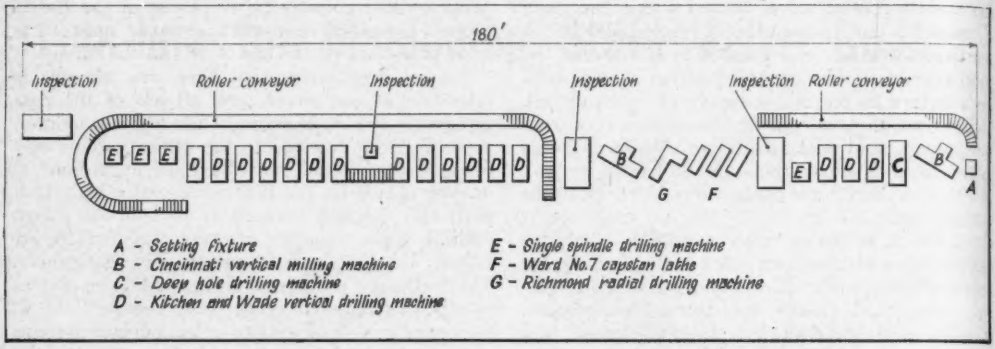


Fig. 2. Diagrammatic plan view of the line installed at the Dowty Exhall works in Coventry, for the production of the valve body seen in the heading illustration

single-spindle drilling machines. It should be noted, however, that several of the latter will eventually be withdrawn as the operations they perform are to be carried out with special equipment which is at present in course of design and will later be incorporated in the line.

DEX MULTI-SPINDLE DRILL HEADS

The Dex multi-spindle drill head system was developed by Designex (Coventry), Ltd., and comprises, basically, a wide range of standard spindle assemblies and gears which are available from stock. With this arrangement, the head casing is the only special item required, and this is made with the number of bores desired, arranged at the specified centres. When the multi-spindle head is no longer required, it may be dismantled, and the spindle assemblies and gears are returned to store for future use.

There are three main types of spindle assembly, of which the series 1 is intended for normal duty drilling and reaming, and has a light angular contact bearing in the upper position and a light or medium angular contact bearing at the nose end. Series 2 spindles are intended for heavier duties, including drilling hard materials, and rough boring, and each has a light angular contact bearing at the top, and an angular contact and a ball journal bearing at the nose end. Suitable for heavy-duty machining, to accurate depths, the series 3 spindle incorporates a thrust bearing at the nose end, in addition to the normal angular contact and ball

Fig. 3. General view of the production line showing two of the three batteries of Kitchen & Wade machines which are equipped with Dex multi-spindle drilling heads

journal bearings as provided for the other types.

A wide range of standard gears is available, with teeth of 10, 12, and 16 d.p., made from 45-ton carbon nickel steel, and hardened and ground. Idler spindle assemblies are also available, designed to carry single or double-element transmission gears, and there are transfer spindle assemblies whereby drive can be transmitted from one compartment to another within the casing. A simple code numbering system has been developed whereby all the spindles and gears have identification numbers, and with this arrangement the tool drawing office is required only to produce a drawing of the casing with the hole centres included, the necessary spindle assemblies and gears being designated merely by the code numbers.

THE VALVE BODY LINE

A general view of the production line from the finishing end is given in Fig. 3, where the two main groups of Kitchen & Wade machines, equipped with Dex multi-spindle heads, can be seen. Attached to the front of the drill head at each drilling station, and in some convenient position at every other station, there is a large-scale sectional drawing which shows the machining operation to be performed, and a number of these drawings can be seen in Fig. 3. Also visible in this illustration, in the left foreground, is the return portion of the roller conveyor whereby the empty platens are despatched to the starting end of the second battery of Kitchen & Wade machines.

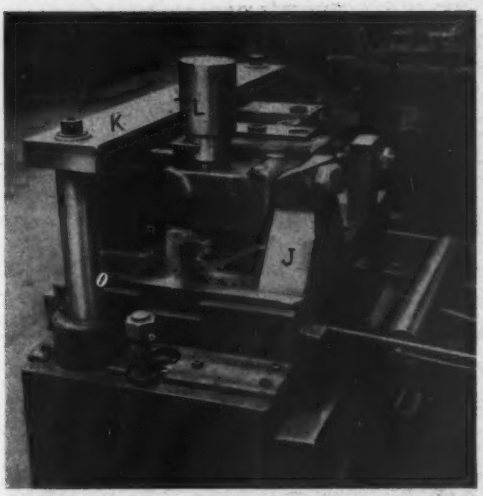


Fig. 5. A platen containing a valve body is here seen in the setting jig, prior to the first operation

Fig. 4 shows three views of a finished valve body, which afford an indication of the complexity of the machining involved. The first operation on the line provides for milling the side which is uppermost at the left in Fig. 4, and in preparation for this stage, the forged body is set up in its platen with the aid of the fixture seen in Fig. 5. This simple unit, which is indicated at *A* in Fig. 2, is installed at the end of the return conveyor for platens, and serves to hold one of the latter while the forging is positioned, to equalize, as far as possible, the machining allowances. The platen *J*, Fig. 5, is located in position by means of two air-operated plungers, which are moved vertically upwards from the fixture and engage with two bushed holes in the underside. These holes serve for location at all subsequent stages, each machining station being provided with a similar pair of air-operated plungers.

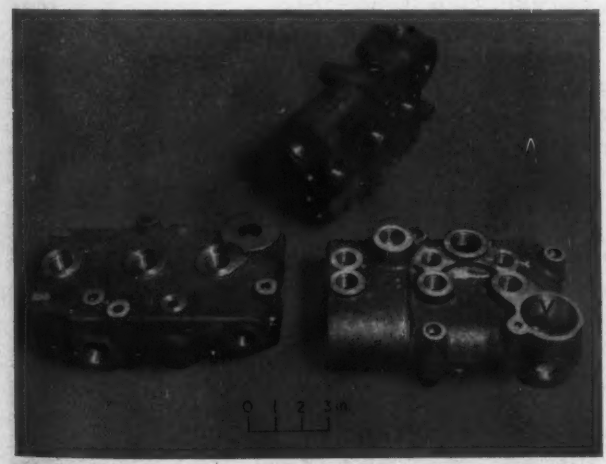


Fig. 4. Three views of a completed valve body for the Dowty Roofmaster hydraulic pit prop. Machined from a steel forging, the component incorporates a large number of intersecting holes, tapped holes, and valve seatings

Spanning the platen, when it is in the position shown in Fig. 5, there is a bridge member *K*, which serves to support a number of sighting pieces. One of these pieces, for example, has a concave end surface whereby the

Fig. 6. One face of the forging is milled on a Cincinnati machine equipped with two coaxial Galtona cutters

sighting block *L* can be located. At the lower end, this block is of reduced diameter and matches, approximately, the surface of a raised pad on the upper face of the forging. The latter is moved slightly in its seatings until the pad and sighting block are aligned, and until other sighting pieces register with other pads and bosses, and the clamps are then applied. From this fixture, the platen, complete with clamped forging, is loaded into a fixture on the table of a Cincinnati machine, on which the top face of the work is milled. For this operation, a close-up view of which is shown in Fig. 6, two concentrically-mounted cutters are employed. The smaller cutter machines the three pads arranged along the centre line of the body (view at the left in Fig. 4) and the larger cutter mills all the remaining pads and bosses. There is a difference of 0·22 in. between the heights of the two cutters, the smaller projecting beyond the larger. Both cutters are of the Galtona type, supplied by Richard Lloyd, Ltd., and are driven at a speed of 60 r.p.m., with a feed rate of 2½ in. per min.

DEEP-HOLE DRILLING

From the Cincinnati machine, the loaded platen is passed to the only machine in the line which may be termed special. This unit provides for deep-drilling three holes in one end face of the valve body, and these holes can be seen in the valve body which is seen at the rear of the group in Fig. 4.

Fig. 7 is a general view of the machine, and it incorporates a Kitchen & Wade horizontally-mounted unit head, with provision for step-feed, and a Dex 3-spindle drill head. There are two machining stations, at which loaded platens are seen in position at *M* and *N*, and at the first station (nearer the camera) one ½-in. diameter hole is drilled to a depth of 7¾ in. Simultaneously, at the second station, one ½-in. diameter hole is drilled in another component to a depth of 4⅝ in. and a ⅝-in. diameter hole is drilled to a depth of 7¾ in.

These holes are subsequently extended in depth—at smaller diameter—and counterbored, at other stations further down the line. It is eventually intended, however, to perform these opera-

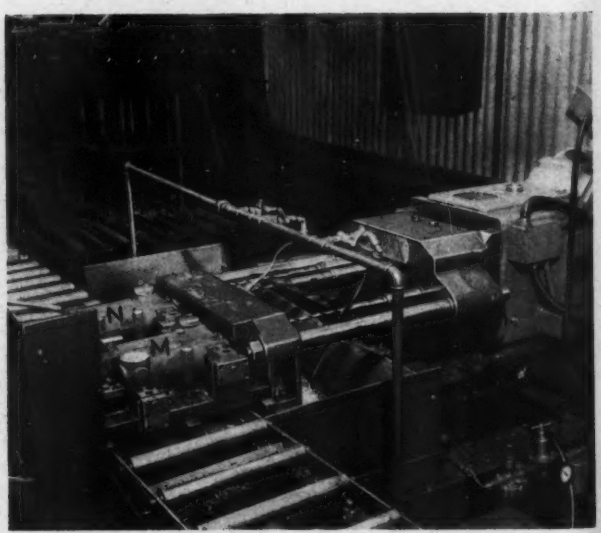


Fig. 7. Three holes are deep-drilled on this 2-station machine which incorporates a Kitchen & Wade unit head with provision for step-feeding

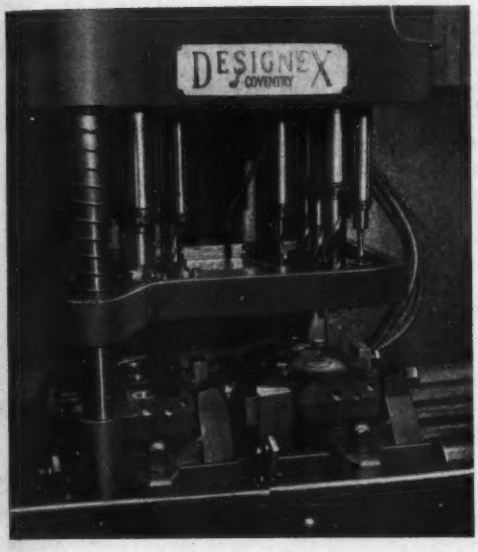


Fig. 8. Typical 2-station drilling and reaming set-up in the first battery of Kitchen & Wade machines. The platens are passed from machine to machine on transfer rails

tions by means of a Dexmatic [Designex (Coventry), Ltd.] unit head mounted to the left of the Kitchen & Wade head seen in Fig. 7. The transfer rails will be extended to provide an additional locating position, and further air-operated locating plungers will be incorporated for platen registration. The roller conveyor seen in the foreground in Fig. 7 leads from the Cincinnati milling machine already mentioned, and those in the left background serve to deliver the platens to the first battery of Kitchen & Wade drilling machines. In the right background can be seen part of the roller conveyor whereby empty platens are returned to the setting fixture seen in Fig. 5.

A close-up view of the first machining station of the first battery of Kitchen & Wade drilling machines is given in Fig. 8, and this set-up is typical of those at the remaining stations. This machine is equipped with a 10-spindle Dex head, and there are two machining stations, that at the right providing generally for drilling and that at the left for reaming. The platens are initially located by means of rail-type guides, and are finally positioned by air-operated plungers which are moved upwards to engage bushed holes in the platens. Each platen is locked by means of two clamps, one at the front and one at the rear, both clamps being applied from the front position. It may be noted that simple swinging stops, as at *P*, serve to locate the platens longitudinally, to receive the plungers.

On leaving the last drilling machine in this section, the valve bodies are removed from the platens and passed to an inter-stage inspection bench. Empty platens are returned by way of the conveyor, and the valve bodies then proceed to the second section of the line, which includes a battery of three Ward No. 7 DS capstan lathes. Various heavy drilling boring and reaming operations are carried out on these machines, and a typical set-up is shown in the close-up view Fig. 9. The valve body is held in a special fixture, secured to a face-plate, and is located therein by plungers which enter small-diameter holes drilled on the first section of the line.

The set-up in Fig. 9 provides for machining a 7-in. deep hole from one end face of the valve body. This hole has four diameter steps, and all

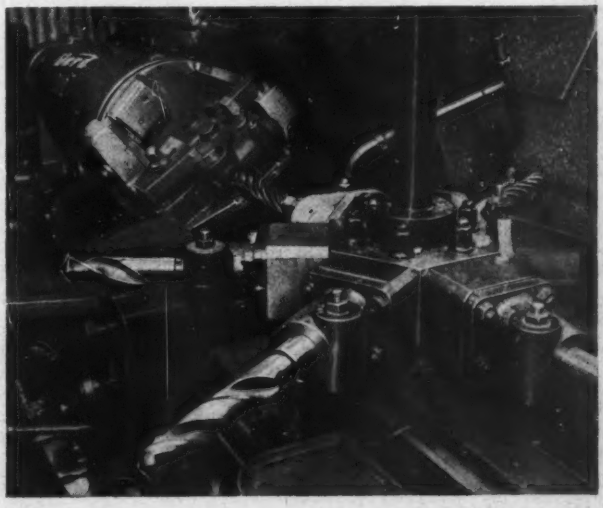


Fig. 9. This set-up on one of three Ward capstan lathes provides for drilling and reaming a multi-diameter hole. Special stepped-diameter reamers are used at the fifth and sixth turret positions

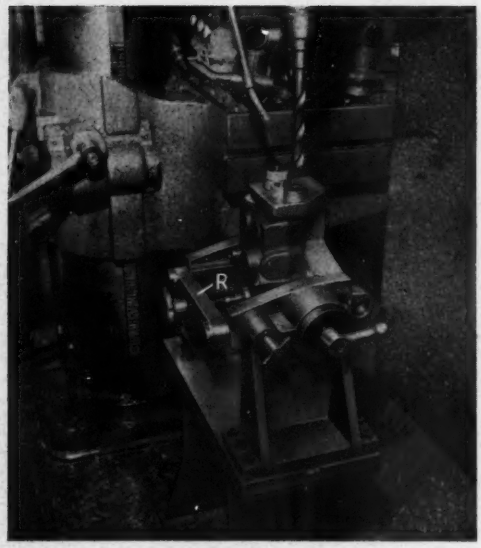


Fig. 10. This trunnion-mounted indexing fixture is provided on a Richmond radial drilling machine for operations on the end faces of the valve block

six turret faces are employed. Faces 1 to 4 provide for successively drilling different diameters, to various depths, and faces 5 and 6 are employed for rough and finish reaming operations, with special stepped reamers. The finishing reamer is seen in the operating position, and the roughing tool is carried in the adjacent turret face, to the right. It may be noted that the largest diameter of this hole, at the outer end, which extends for a depth of 2·39 in., must be held to ±0·0005 in., and typical limits on diameters for other, deeper, portions of the hole are ±0·001 in. and ±0·004 in. Two (separated) portions of the hole require to have smooth surface finishes, free from tool marks, and to be concentric within ±0·0015 in.

From the capstan lathes, the valve bodies are transferred to a Richmond radial drilling machine (Midgley & Sutcliffe, Ltd.) and are loaded into a special trunnion-mounted indexing fixture. This unit is shown in the close-up view Fig. 10, and serves to hold the work while various holes of different diameters and depths are drilled in the end faces. The fixture is a simple U-shaped casting, incorporating the necessary locating arrangements to suit the valve body, and has a pivoted latch *R* which can be swung to one side to facilitate loading.

At the centre of this latch there is a single clamp screw, which applies thrust by way of a floating pad to one face of the valve body, to secure it in the fixture. One wall of the fixture has two bushed holes, to receive the nose of a sliding plunger, and with this arrangement the fixture can be located accurately in two positions, 180 deg. apart.

From the radial drill, the valve bodies are transferred to another Cincinnati vertical milling machine, whereon the other side is machined, at a set-up which is very similar to that shown in Fig. 6. Second-stage inspection and deburring follows, after which the forgings are ready to enter the third and final section of the line. When inspection has been completed, the bodies are loaded into special platens, of the type seen in the right foreground in Fig. 11. For location, there are plungers which project from the platen

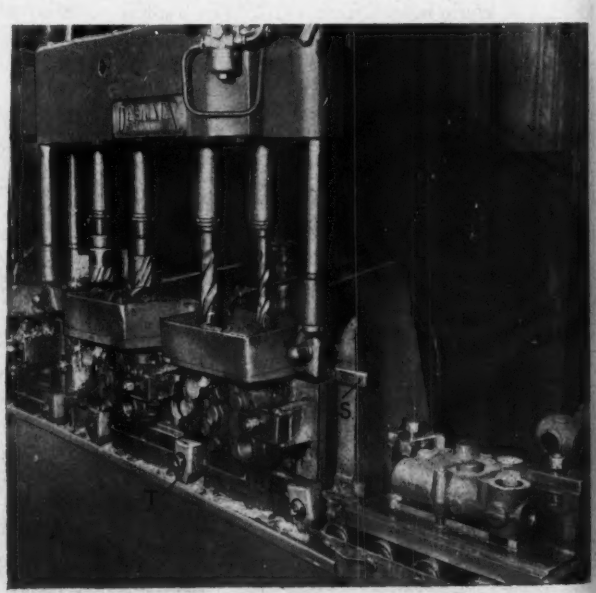


Fig. 11. On entering the final section of the production line, the components are loaded into platens of different design and are passed beneath the machines on edge

and enter previously-drilled holes, and the forging is secured by a heavy clamp which is provided at each end.

Early operations on this section of the line are concerned with drilling and reaming holes in the edge of the forging, and the platens are turned through 90 deg. from the position shown at the extreme right in Fig. 11. Rails, as at *S*, provide for guiding the platens, and they are thrust back against these rails by clamps *T*. Air-operated plungers are provided at each machining station, to locate the platens, and are controlled by lever-type valves as seen at the top in Fig. 11. The blocks are passed beneath four drilling machines, all with Dex multi-spindle heads, for a series of operations on one edge, and between the fourth and fifth machines in this section there is a simple turn-over unit, whereby the platen and work is turned through 180 deg., to present the opposite edge for machining.

A close-up view of this turn-over unit is given in Fig. 12, where the spindles of the fourth machine can be seen at the right. This station provides for tapping two threads in bosses on the edge of the forging. At the completion of these operations, the platen is slid to the left, into engagement with the rails provided on the turn-over unit *U*, and an L-shaped stop at the extreme left prevents it from travelling too far. This stop also provides support when the turn-over unit is swung through 180 deg., in an anti-clockwise direction, to align the platen with the transfer rails of the next machine in the line. These rails are just visible to the left of the turn-over unit in Fig. 12.

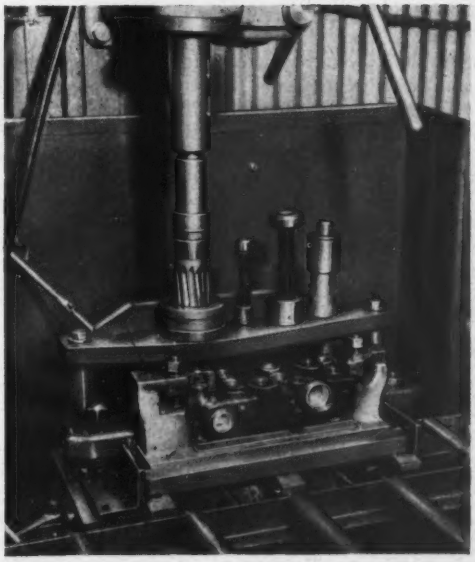


Fig. 13. On one of the last machines in the line, two concentric holes are reamed to close limits

After operations on this edge of the forging have been completed, the parts are diverted from the line, to the last inter-stage inspection bench, before being passed to a final battery of six Kitchen & Wade machines. In this section, the platens are again laid flat, and the transfer rails, clamping, and locating arrangements are generally similar to those already described. After leaving the last Kitchen & Wade machine, the parts are brought to a single-spindle drilling machine for a composite reaming operation. The hole *V*, Fig. 4, is 2⅛ in. diameter by 2¼ in. deep, with a flat bottom, and there is a 1·000-in. diameter reamed hole con-

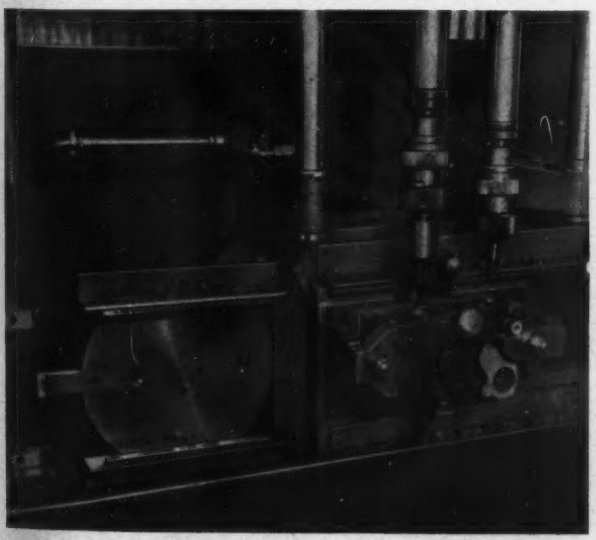


Fig. 12. This simple turn-over unit is installed between the fourth and fifth machines in the last section, and provides for swinging the platen through 180 deg.

centric with it. The latter hole has limits of ±0·0006 in. on diameter, and must be concentric with the 2⅛-in. diameter hole within 0·001 in. total indicator reading. The two holes are reamed at the set-up seen in Fig. 13, for which there are transfer rails arranged at right-angles to the run of the roller conveyor from the last Kitchen & Wade machine. On top of the fixture can be seen the "go" and "not go" gauges for the large and small diameter holes, and at the extreme right, the composite gauge which serves to check the concentricity of the two holes.

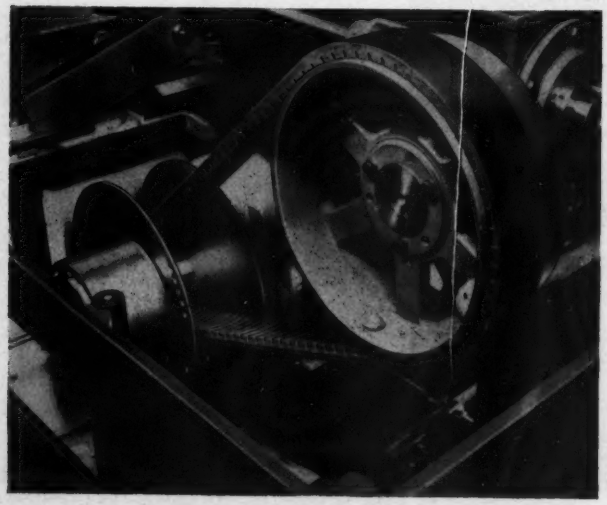
As various holes are completed throughout the line, they are sealed by means of pressed steel threaded plugs, two of which can be seen in position in Fig. 13. These plugs are inserted at the various inter-stage inspection stations, and prevent the ingress of swarf and other foreign matter during subsequent operations. A number of finishing operations is carried out on the battery of single-spindle drilling machines at the end of the line—at the extreme left in Fig. 2—after which the blocks are passed to the final inspection bench. Here, all machining is checked, particular attention being paid to the surface finishes of a number of valve seatings, shoulders, and spotfaces. Finally, all the holes are sealed off with plugs and the valve bodies are passed for despatch.

Steplessly-variable Pulley Drive System

In the figure is shown part of the drive system of the Lan-Nu-Rol thread rolling machine, built by Landis Machine Co., Waynesboro, Penn., U.S.A. To provide for all thread pitches and diameters within the range of the machine, the roll spindle speeds are steplessly variable over the range from 166 to 500 r.p.m. No change gears are incorporated in the transmission from the 7½-h.p., 1,750-r.p.m. motor, adjustment being obtained by means of a variable-speed pulley drive system. With this arrangement, it is only necessary to alter the position of the motor, by turning a hand crank, the output speed of the drive being indicated by a pointer on an engraved reference plate.

A standard type MS-127-10 drive unit, made by T. B. Wood's Sons Co., Chambersburgh, Penn., U.S.A., is employed. This unit comprises a flat driven pulley and an adjustable driving pulley, connected by a serrated belt. Of 72 in. pitch length, the belt is 2¾ in. wide by ⅜ in. thick, and the driven pulley is 12 in. diameter, with a face width of 5 in. The driving pulley flanges are adjustable to provide pitch diameters from 4¼ to 12¾ in. It is claimed that with this drive system periodic variation through the speed range is unnecessary, and that a set speed can be maintained indefinitely without sticking. Maximum speed is obtained with the motor adjusted to the greatest extent towards the driven pulley.

Special precautions have been taken to prevent fretting corrosion and sticking. Bearing surfaces on the driving pulley are supplied with oil from a reservoir at each revolution. There are no metal keys to obstruct the flow of lubricant, and power is transmitted from the non-sliding to the sliding pulley-flange by fabric-faced rubber keys, located outside the bearing surfaces, within a removable sleeve cap. The torsionally-resilient keys transmit the torque, and ensure even distribution of the load and equal transmission of power by both flanges.



Close-up view of the steplessly-variable pulley drive system which is provided on a Landis Lan-Nu-Rol thread-rolling machine

Making Metal Spectacle-frames

Methods Employed by the British American Optical Co., Ltd., Watford

By S. C. POULSEN, Associate Editor

In earlier articles in MACHINERY (81/380—28/8/52 and 81/1265—19/12/52) were described certain processes and equipment employed in the manufacture of metal spectacle-frames at the Watford, Herts., frame factory of the British American Optical Co., Ltd. More recently (98/553—8/3/61), some examples of press operations and bending equipment were discussed, and other typical production and assembly procedures are here considered.

PRODUCING THE "ENGRAVED" PATTERN

It will have been noted from some of the illustrations accompanying the previous article that several of the components are "engraved"—in certain instances elaborately—with finely-detailed decorative patterns. In order to facilitate the preparation of the dies, which are of ordinary oil-hardening steel, use is made of the hobbing process. For some components, the engraved pattern is produced on the die, by the same hob that forms the main cavity. Alternatively, the engraving may subsequently be impressed on the cavity surface with a separate hob. Similarly, the work may be coined and impressed with the engraved pattern simultaneously in a single tool, or separate press tools may be used for coining and "engraving." This procedure is adopted, for example, for the brow bars, and after the engraving has been impressed, the components are re-struck in the original coining dies, to correct any distortion. The engraving on this component, it may be noted, is provided on the outer portion of the head bend radius (as seen in Fig. 1 of the previous article).

For forming the "pallets," as the hinge-lugs at the temple attachments are termed, the heads of the blanks are "pinched" to the form shown at *A*, Fig. 1. Pinching is carried out by the use of press-tools, the work being placed in cavities in spring-loaded dies. Opposed punches are mounted above and below the die-plates, with compression-springs interposed between the die-plates and the punch-plates. When the press is operated the work is first gripped in the die-cavities. Then, as the resistance of the compression-springs is overcome, the punches are forced together through holes in the dies. The opposed punches, which are of circular section, form a disc-shaped projection of reduced thickness, which remains attached to the main body of the material. This projection is subsequently pierced by means of a conventional punch-type press-tool equipped with a stripper, after which the pallet-radius is trimmed by cropping and the "set-back" is machined by a milling operation.

The "set-back" is the term applied to the stop-faces at the hinge-points, which in conjunction with corresponding faces on the temples, serve to limit the travel of the latter about the hinge screws.

MILLING THE "SET-BACK"

For milling the set-back on the brow-bars, the equipment shown in Fig. 2 is employed. A horizontal spindle, driven at 1,000 r.p.m., carries a 30-tooth 1⅛-in. diameter profiled cutter. Normally, the cutter is enclosed in a cylindrical guard which has been removed for purposes of illustration. Beneath the cutter there is a sliding carriage *B* upon which is mounted a special vice. The moving jaw of the vice is cam-actuated by means of the lever *C*, and each jaw has a cavity that corre-

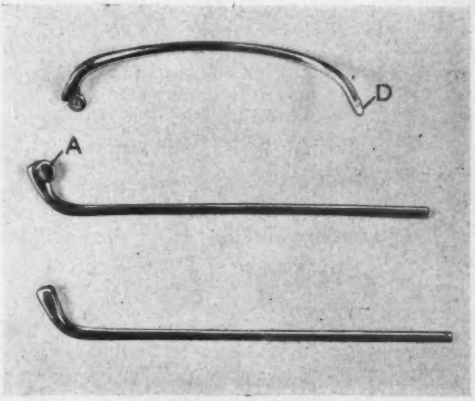


Fig. 1. The sequence of operations involved in forming the hinge lugs at the ends of temple-attachment components includes "pinching," piercing, cropping, and milling

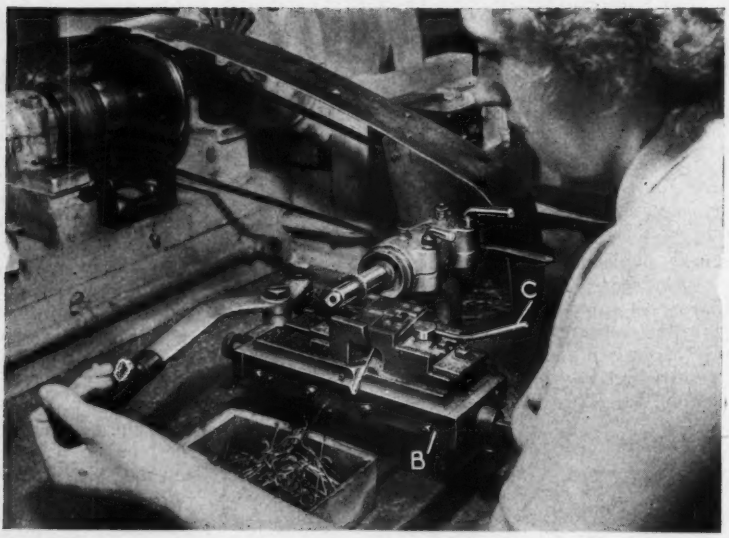


Fig. 2. A special machine with a spindle fitted with a profiled cutter, running at 1,000 r.p.m., is employed for milling the "set-back" or hinge-stop face on the brow bar

sponds to the shape of the work. Positive location of the pivot-centre in relation to the cutter is ensured by a pin on the moving jaw. When the jaw is closed, this pin enters the punched hole in the pallet, and with the work thus located, it is traversed beneath the cutter by means of a hand-lever, which actuates the sliding carriage.

With this equipment, approximately 400 pieces are milled per hour, and a very similar set-up is employed for forming a shallow semi-circular cut in the opposite end of the same workpiece. This cut, which is indicated at *D* in Fig. 1, ensures a neat soldered joint between the brow-bar and the pad-arm when the components are finally assembled. Before this cut is taken, the end of the brow-bar is given a slight set to ensure that it does not foul the bridge-piece. This setting operation, also, is carried out with a simple press-tool.

In general outline, the sequence of operations employed in making the temples closely resembles that adopted for the brow-bars. The pallets, however, are formed entirely by forging and coining, and a greater amount of cold-working is carried out on the shank-portions in order to obtain a light, springy section. In addition, the pallet is slotted to form hinge-lugs that fit on each side of the brow-bar pallet, and the slotting operation is carried out at a milling set-up very similar to that employed for the brow-bar set-backs. In this instance, however, it is necessary to maintain continuity of the gold layer all over the external surfaces.

SOLDERING THE FRAMES

In soldering the frame components, extensive use is made of resistance-heating equipment, and the conductors also provide for clamping the pieces together while the solder is being applied. The solder is in the form of thin wire, usually of about 0·012 in. diameter, and is handled with the aid of a hollow, pencil-like holder. The holder has a small roller mounted in the side, and rotation of this roller feeds out a length of wire as required. Two main types of solders are employed, both supplied by Johnson Matthey & Co., Ltd. One type is a gold solder, of 7 or 9 ct. grade, and the

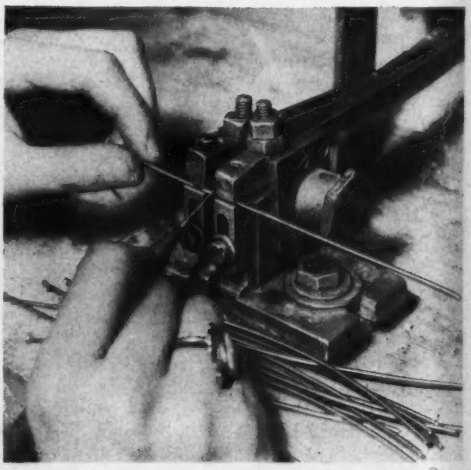


Fig. 3. Set-up for soldering flexible cables to the temples. Resistance heating is employed and the joints are subsequently swaged

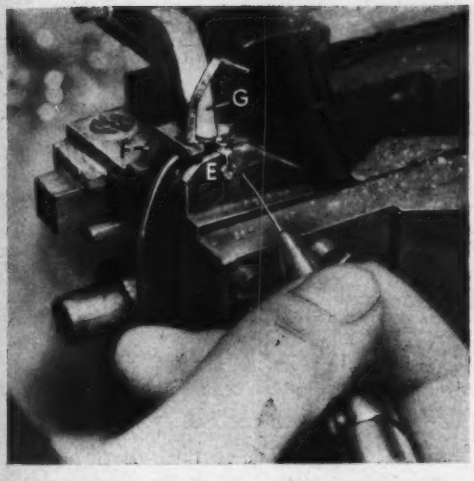


Fig. 4. Close-up view showing the arrangement of the beryllium-copper conductors in the set-up for soldering the bridge to the brow-bar and lens-strap sub-assemblies. Easiflo solder is used since the joint is nearly opposite that between the strap and pad-arm

other, also with an appropriate gold-content, is known as Easiflo. The latter has a melting-point (630 deg. C.) which is somewhat lower than that of the standard gold-solders, and is therefore frequently employed where the heating of one part of the assembly might otherwise entail risk of remelting an adjacent, already-completed joint.

The resistance-heating equipment is designed to operate within a range of 4 to 6 volts, and the conductors employed are chiefly of beryllium-copper. For soldering the flexible cable for ear-loops to temple-wires, the set-up seen in Fig. 3 is employed. The pieces are united by a simple butt-joint, and for this purpose pedal-operated clamp-type electrodes are used. The pieces are placed in the electrodes with their ends touching, and current is switched on. As soon as the required temperature is reached, the solder-wire, previously dipped in a powdered flux, is pushed rapidly into the heated zone. Fusion is practically instantaneous, and the very small amount of solder deposited forms a neat, clean fillet. Subsequently, the point is swaged on a hand-fed machine, and it is then almost indistinguishable from the parent-metal of the temple-wire.

In Fig. 4 is shown a rather more elaborate resistance-heating set-up which is employed in assembling the Numont frame. Prior to the stage illustrated, the straps are soldered to the pad-arms, and the pad-arms to the brow-bars, by the use of similar equipment. These sub-assemblies are then soldered to the bridge-pieces in the manner indicated in Fig. 4. Here, again, the electrodes serve as clamping-members, and are pedal-operated. The brow-bar and strap sub-assembly is located by the strap which fits over a flange *E*, while the bridge is supported by an insulated arm *F*. The arm *F* has a recess in which the bridge is located, and clamping is effected by means of the upper conductor *G*.

When the operating-pedal is free, the members *E*, *F* and *G* are separated, so that the pieces can be loaded. The brow-bar and strap sub-assemblies are loaded first, after which the bridge is placed in position and the pedal is operated. This action causes the upper conductor *G* to descend, with the result that the strap is gripped against the insulated arm *F*. Thereafter, *F* and *G* descend together until the end of the bridge-piece contacts the pad-arm. Current is then switched on and the solder is applied in the manner already described. This particular joint, it may be noted, is typical of those for which Easiflo is used, since it is immediately opposite that joining the strap to the pad-arm.

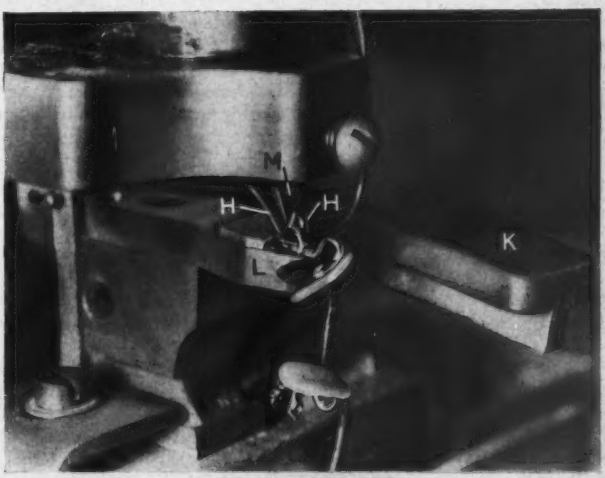


Fig. 5. Resistance heating equipment employed in hot-riveting the lens-mount leaf-springs in the straps. The upper conductor is made from Elconite

The operation may be regarded as typical of soldering assembly practice, and 300 joints are made in an hour.

HOT-RIVETING AND LEAF-SPRING ASSEMBLY

The rivets securing the leaf-springs to the straps (Fig. 2 of the previous article) are closed while heated by electric resistance equipment. Prior to riveting the springs, the pads are assembled to the pad-arms by inserting the shanks through the rectangular holes in the spoons. A cup-washer is placed over the shank, which is then spin-riveted to retain the washer and pad. Fig. 5 shows the equipment for riveting the springs into the straps. The leaves are first placed over the rivet by the use of tweezers, and a pair of spring-loaded fingers *H* is then raised by depressing a lever *K*. With the fingers in this position, the assembly is placed, strap upwards, on the lower conductor *L*, and the lever *K* is released. The fingers *H* descend into contact with the ends of the leaf-springs and thus hold them securely against the bottom face of the strap.

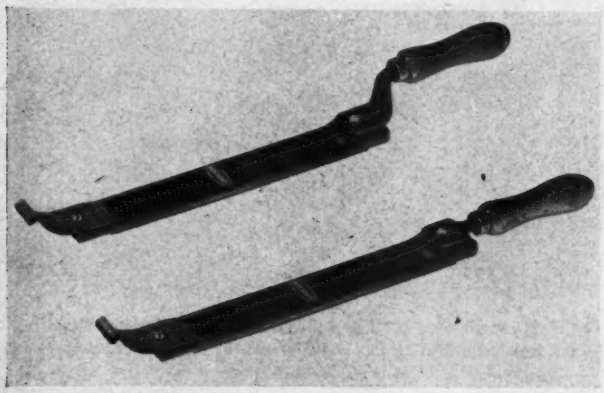
An upper conductor *M*, of Elconite, in the form of a narrow blade, can enter between the arms of the strap, and is pedal operated. A spring is interposed in the linkage between the conductor and the pedal in order to regulate the force exerted on the rivet. In operation, the pedal is depressed to the full extent, travel being limited by a stop. This action, therefore, results in the application of a predetermined force by the conductor on the rivet, regulated by the spring. The force is insufficient to close the rivet in the cold condition, but as soon as the rivet reaches a certain temperature, closure is completed. With this set-up, the springs are assembled and the rivets closed at the rate of 80 an hour.

The operations completed after soldering are straightforward, and include tapping and truing. Tapping of the holes for the temple and the lens pivot-screws is carried out with small, horizontal-spindle, bench-mounted tapping heads. For tapping the temple pivot-screw holes, each temple is engaged with the pallets of the brow-bar, the holes are aligned, and the two pieces are tapped simultaneously. This procedure is adopted in order to ensure that there will be no difficulty in inserting the pivot-screws when they are finally assembled. The screws are of the Evertite type, with small holes in the shanks and are subsequently locked by the use of a hand-tool equipped with a conical punch. This punch enters the hole in the shank, and enlarges the end of the screw. The work is finally checked visually and compared with a diagram for alignment and truth, and any necessary corrections are made by hand bending.

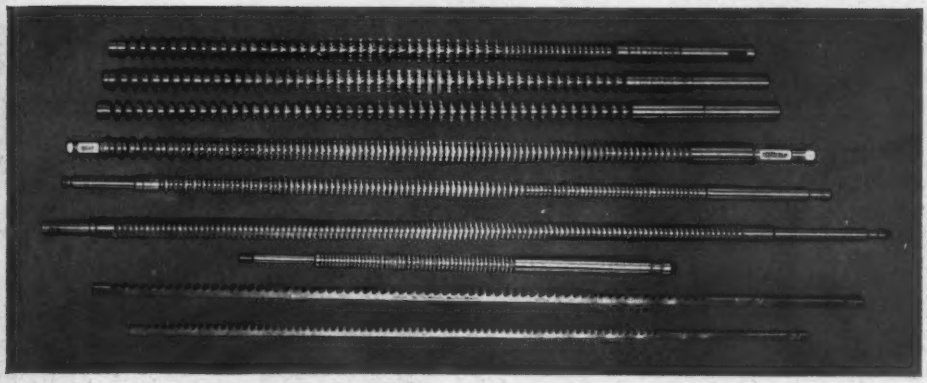
New Surform Industrial Tool

The Surform range of files and planes which is made by Firth Cleveland Tools, Ltd., 7 Cleveland Row, St. James's, London, S.W.1, has been extended to include a new hand tool for industrial use, which is primarily intended for application to metals, such as mild steel, cast-iron, copper, and aluminium. This tool is shown in the illustration fitted with interchangeable straight and cranked handles, which can be adjusted laterally and set in different angular positions by means of locating studs.

Of the distinctive perforated pattern associated with Surform files, the replaceable blue-coloured blade incorporates certain modifications to the position of the cutting teeth in relation to the corrugations, which, it is claimed, result in smoother, chatter-free cutting and longer blade life. Controlled depth of cut with a relatively light pressure is obtained, and swarf passes through the perforations so that clogging is prevented.



The new Surform industrial tool introduced by Firth Cleveland Tools, Ltd., for metal cutting is here shown fitted with interchangeable straight and cranked handles



A Modern Factory for Broach Production

By S. C. POULSEN, Associate Editor

THE FIRM OF FORST BROACH CO. (GREAT BRITAIN), LTD., Dartford Road, Leicester, was established in 1957, to produce broaches in this country on the basis of the extensive specialized knowledge and experience of the German Forst organization (Oswald Forst Maschinenfabrik und Apparate-Bauanstalt G.m.b.H., Solingen) in this field. This latter company has been concerned exclusively with the building of broaching machines (agents, Drummond-Asquith, Ltd.) and the production of broaches, for a period of some 50 years. The training of British executive staff, who were responsible for organizing and equipping the Leicester factory, was begun at Solingen in 1959, and production was begun at Leicester in July, 1960.

The main shop accounts for 8,000 sq. ft. of the total of 18,500 sq. ft. of floor area available, and when the current equipment programme has been completed, the output capacity will be 100 broaches per working day. Completion of this programme will mainly entail the duplication of machines already installed, to increase productive capacity progressively to the level indicated, in accordance with demand. Apart from those of standard general-purpose type, special-purpose Forst machines designed specifically for broach-making duties are used exclusively. Typical of the latter are spline grinders, throat grinders, flat broach-tooth sharpeners, and climb-milling machines for operations on all types of broaches. In addition, a standard 40-ton Forst horizontal broaching machine is employed for testing.

HEAT-TREATMENT EQUIPMENT

Because of the critical nature of the heat-treatment required in broach manufacture, the company have designed and built all their own equipment for this purpose, in close collaboration with A. R. Wade, Ltd., North Lane, Aldershot, Hants. A view of the heat-treatment shop, showing the six special pit-type electric furnaces, is given in Fig. 1. The group comprises five salt-bath furnaces and one static-air preheating furnace, all of which are 6 ft. 6 in. deep. Three of the salt-bath furnaces are of the electrode type, two being employed for preheating and one for hardening. The latter process necessitates extremely close control of temperature and time, to ensure uniform hardness throughout the work, and there must be no measurable temperature gradient over the depth of the bath. Quenching and tempering are carried out in the remaining two salt-bath furnaces, which are fitted with stainless steel liners to resist attack by the salt.

Typically, the programme for heat-treatment, machining and grinding is as follows. Stress-relieve in air furnace; machine; preheat in three stages; heat to hardening temperature; salt-bath quench; straighten; secondary harden; again

straighten; final secondary harden; final straighten; grind. To ensure the non-fluctuating current supply necessary for the highly-accurate temperature-control required, the company has installed power generating plant. This plant comprises two 8-cylinder Peter Brotherhood 475-h.p. Ricardo diesel engines, each driving an English Electric generator, and the total output capacity is 660 kW.

As a precaution against the transmission of vibration to the shop floors of the factory, both engine/generator units are mounted on a single large block of concrete, 6 ft. thick. This block is housed in a pit of the same depth, and rests on a 1½-in. layer of special rubber, supplied by Metalastik, Ltd., in collaboration with Dunlop Rubber Co., Ltd. Beneath this layer there is a further 6-ft. thickness of concrete, the upper face of which forms the pit floor. Temperature control of the furnaces is obtained by means of platinum thermocouples, in conjunction with instruments and associated equipment supplied by West Instrument, Ltd., 52 Regent Street, Brighton, 1, Sussex, and Ether, Ltd., 60 Tyburn Road, Erdington, Birmingham.

The broaches produced by the company are of high-speed steel, and some representative examples are shown in the heading illustration. These examples comprise, from top to bottom, a set of three combination broaches for producing 16 internal splines of 1·7716-in. major diameter; a 10-spline combination broach for 1⅝-in. major diameter; a broach for producing 1·0236-in. square holes, starting from 1-in. diameter; and 0·315-in. and 0·1968-in. keyway broaches.

Fig. 2. The machining of the teeth, grooves, and throat-radii on a typical circular broach is here seen in progress on a Monarch CK 12-in. centre lathe

Fig. 1. In this view of the heat-treatment shop may be seen some of the special pit-type furnaces. Very close control of time and temperature is necessary

MACHINING OPERATIONS

The procedure for producing circular broaches is normally as follows. After the stress-relieving heat-treatment, the bar stock is faced to length, and then centred on a special-purpose machine designed and built by the company. This machine ensures concentricity within 0·001 in., total indicator reading. Next, the bar is turned over the full length to the maximum diameter, plus machining and grinding allowances, and the shaft and tail diameters, and the tooth-rise tapers, are also turned. To serve as a guide for machining the teeth, a series of shallow circum-

ferential vee grooves, of the appropriate pitch, is turned at intervals along the length. The positions of these grooves are established with the aid of a steel rule clamped to the lathe bed, in conjunction with a pointer mounted on the saddle.

Teeth, grooves and throat radii are next turned with an offset radius tool, and a typical set-up for this purpose, on a Monarch CK 12-in. centre lathe (Rockwell Machine Tool Co., Ltd.), is shown in Fig. 2. As may be observed, the work is supported by a steady, which is kept as close to the saddle as possible. During this stage, the throat diameters are machined to taper with the teeth, so that the tooth depth is proportionate to the pitch, and the cutting angle on the front face of each tooth is also rough machined. After the tooth-form has been machined throughout the working length of the broach, the pulling slot, if required, is milled on a Milwaukee No. 3 universal machine.

On large splined broaches, the splines are next cut on Forst spline milling machines of the design shown in Fig. 3. These machines are hydraulically operated throughout, including the cutter-spindle drive, which provides steplessly variable speeds from 150 r.p.m. to practically zero, and is reversible at all speeds. The cutter-head, it may be noted, is arranged to traverse, while the work is held stationary, and the traverse speed also is steplessly variable. Typically, a 4-in. diameter cutter is run at 80 to 100 r.p.m., with a feed of 3 in. per min. As may be observed, one end of the work is held in the chuck of a dividing head, and the opposite end is engaged by the tail-stock centre. Intermediately, it is supported by self-centring steadies, with vee fingers. The brackets that carry the fingers are interchangeable, and work up to 4 in. diameter can be accommodated.

The various manual controls are extremely simple, and include a handwheel for moving the cutter spindle axially, for aligning the cutter with the work. An unusual feature is that the "drag" of the cutter-head slide on the ways is also adjustable, by means of the handwheel *A*, with reference to an associated pressure gauge. This arrangement provides damping and preload effects in the feed system, to prevent the cutter "taking control" when climb milling.

The foregoing operations complete the machining carried out on the work in the soft state, and are followed by the heat-treatment and straightening stages already outlined. Straightening is carried out by mounting the work on a lathe, and setting it with a length of bar, which is used as a lever, against a suitable support. At the first and second straightening stages, after hardening and secondary hardening, the work is trued visually, whereas at the final stage, it is checked with a dial gauge. Before it is ground, the machined broach blank is checked for hardness, which must be within 63 to 65 Rockwell C throughout the working length.

GRINDING OPERATIONS

Grinding of the throat diameters, which follows, is carried out between centres, on Forst machines of the simple basic design shown in Fig. 4, comprising a 4-speed headstock, tailstock, and Fortuna swivelling wheel-head. Unless otherwise stipulated, it is the firm's practice to grind the throat-portions only, and to leave the backs of the teeth unground. Throat diameters are plunge ground with a radiused wheel, feed being applied by hand. For this purpose, fairly soft wheels, such as 46- to 60-grit Aloxite are employed, and wheels of the size seen in use in Fig. 4 (approximately 2 in. diameter) are run at 5,500 to 6,000 r.p.m.

Fig. 3. A typical set-up on a Forst special-purpose spline milling machine. These machines are hydraulically operated throughout, including the cutter spindle drive

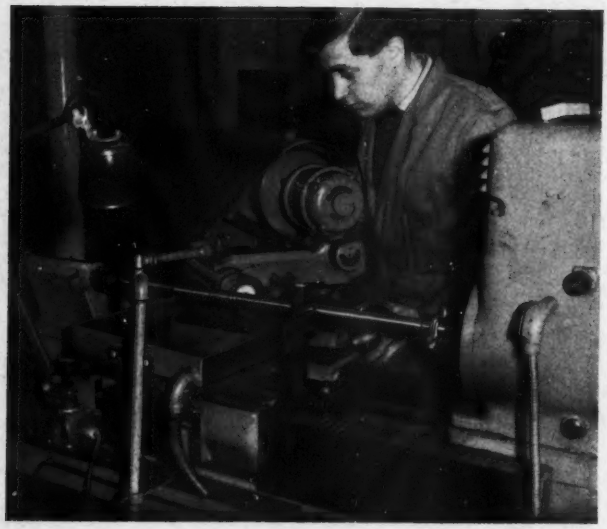


Fig. 4. Forst special-purpose machine for throat-grinding circular broaches. These machines are equipped with Fortuna swivelling wheel-heads

Equipment employed for the ensuing stage, at which the shaft and tail diameters, tooth tapers, and tooth clearance angles are ground, includes a Cincinnati 6-in. swing cylindrical grinding machine, with a maximum capacity between centres of 72 in.; a 6- by 72-in. Haubold (German) cylindrical machine; and Fritz Werner and Myford machines with capacities of 18 by 2½ in. and 12 by 2 in. respectively. The two latter machines, it may be noted, are used for short push-type broaches. A 6- by 72-in. Naxos-Union machine will also be installed shortly. Typically, the shaft and tail diameters are ground first, after which the tops of the teeth are taper ground. The teeth are then backed-off by plunge grinding. For the ensuing operations of spline, profile or compound form grinding, depending on the type of broach that is being made, Forst spline-grinding machines of the design shown in Fig. 5 are employed.

On this machine, which has a maximum length capacity of 7 ft., the table is traversed hydraulically, and is controlled by means of the "joy-stick" lever seen in use. With the lever in the central position, the table remains stationary, but when it is moved to either side of this position, the table travels in the same direction. The speed is steplessly variable according to the angular displacement of the lever, and reversal can be effected at any point in the stroke. As a safeguard against over-run in either direction, adjustable automatic trips are provided. To cater for the grinding of various tapers, the table can be inclined to either direction from the horizontal, by 2 mm. (0·079 in.) on a base-length of 2,020 mm. (79·5 in.) on the sine-bar principle. The associated control for these settings is calibrated so that it can be read directly to 0·010 mm. (0·0004 in.).

The table is equipped with a special Maag high-accuracy dividing head, on which provision is

Fig. 5. Features of this Forst spline-grinding machine include steplessly variable wheel and table speeds, the latter controlled by the "joy-stick" lever seen in use

Fig. 6. Tooth-relieving a flat broach on a Forst type SM broach sharpening machine. This machine is manually operated throughout, including the ram-type wheel-head

made for rotating the work independently of the index-plate, for setting purposes, and the tailstock is adjustable vertically and laterally. Intermediately, the work is supported by adjustable steadies, as shown. This machine also incorporates a Fortuna grinding spindle, which is driven by a d.c. motor, and the spindle speed is steplessly variable. The spindle is adjustable axially, for aligning the wheel with the work, and the control for this purpose, as well as that for raising and lowering the wheel-head, is provided with vernier scales that can be read directly to 0·005 mm. (0·0002 in.). Angular diamond-dressing attachments are provided for both sides of the wheel, and there is another, mounted on the table at *B*, for radiusing the periphery. Other diamond attachments are also available for dressing the sides of the wheel, for grinding involute splines, and a recent addition to the machine, not shown, is a table-mounted Diaform (S. L. Van Moppes, Ltd.) pantographic attachment, with a reproduction ratio of 10 to 1. Master profile plates for this equipment are made on a Hauser type 2 BA jig boring machine, and are checked by optical projection against master drawings at a further 10 to 1 ratio. The overall ratio between the master drawing and the actual broach profile is therefore 100 to 1.

Following this stage, the chip-breaker grooves are ground on small Forst machines of simple design, on which, again, the work is indexed with the aid of a Maag high-accuracy dividing head. On each of these machines, the table is traversed and fed manually, and for grinding the grooves, rubber-bonded wheels are employed.

Fig. 7. This 40-ton Forst horizontal broaching machine is employed for broach-testing and a limited amount of small-quantity production work

FLAT BROACHES

The initial machining of flat broaches is carried out on a small Waldrich (Drummond - Asquith, Ltd.) open-side planing machine, on which the stock is reduced to the required tapering section, plus grinding allowances. The teeth are then rough milled

with cutters of the same grade of high speed steel as the broaches, and the spacing is meanwhile maintained with the aid of a steel rule and pointer, in the same way as for the circular broaches. The various hardening and straightening processes follow, as already described, after which throat-grinding and tooth-relieving are performed on a Forst type SM broach sharpening machine, as shown in Fig. 6.

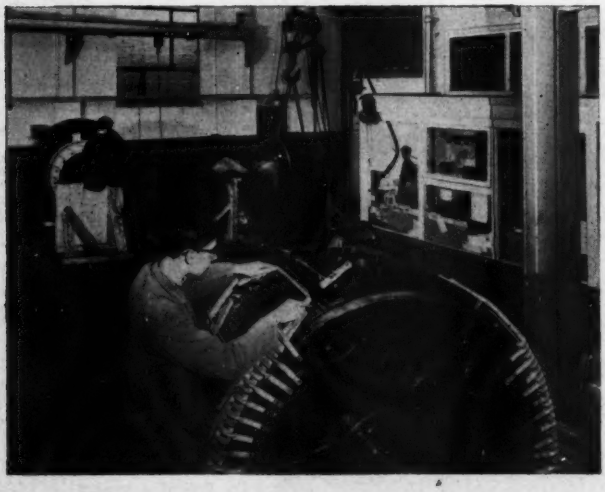
This machine has a ram-type wheel-head, which is reciprocated manually and is mounted on a vertical slide for setting the working height. The maximum horizontal stroke-length is 14 in. Speeds from 2,240 r.p.m. to 7,500 r.p.m. are obtainable, and the wheel spindle can be inclined to any angle between vertical and horizontal. When the spindle is fitted with a cup wheel, and set vertically or at a slight angle to the vertical, face and relief grinding can be carried out. When it is set horizontally, and equipped with a disc wheel, throat grinding operations can be performed on either flat or circular broaches.

For the latter application, a headstock from one of the circular throat-grinding machines (Fig. 4) and a tailstock, can be mounted on the table. Flat broaches are usually held on a magnetic chuck, as in Fig. 6, and each tooth or throat, in turn, is located beneath the wheel, and ground by reciprocating the wheel-head. All the motions on this machine are manually operated, and it is also used for grinding the pulling flats. Finally, the chip-breaker grooves are ground on small Forst machines similar to those used for circular broaches.

The 40-ton Forst horizontal broaching machine used for testing is shown in Fig. 7. This machine is hydraulically operated, and the cutting and return speeds are steplessly and independently adjustable up to 17 ft. per min. and 65 ft. per min., respectively. An automatic overload cut-out can be set to operate at any pull from 2 tons to 35 tons, and a full set of mechanically-operated self-opening chucks is provided. The machine can be set for single-cycle or repeated-cycle operation, and with the latter setting, there is a dwell period for broach removal at the end of each working stroke. In addition to the use of the machine for broach testing, small-quantity production work is undertaken by the company for a number of customers.

Arco Electrical Repair Service

Arco Rewinds, Coventry Road, Sheldon, Birmingham, offer a service, which operates 24 hours per day, for dealing with breakdowns of electrical equipment of all kinds. The repair of motors up to 20 h.p. for customers within 30 miles radius, it is stated, can be completed in 12 hours.



Stripping and rebuilding the three 700-kW. generator armatures from the liner *Cape Town Castle*

As an indication of the facilities available, it may be noted that the company has recently completely stripped and rebuilt three 700-kW. main generator armatures, each weighing 8½ tons, from the liner *Cape Town Castle*. This work, seen in progress in the accompanying illustration, was completed in only three weeks, in spite of the fact that the armatures had suffered severe damage from fire and salt water.

The servicing of hydraulic equipment is also undertaken either on site or in the company's service department. In addition, the company undertakes the application of Arco Seal internal proofing process for the protection of electrical windings against damage from suds, acid, oil, and moisture. It is stated that pump motors which operate in severely polluted atmospheres will remain effective for between seven and eight years when Arco Seal treated.

DIE CASTING SUPPLEMENT

Some Applications of Loose Die Inserts

By H. K. and L. C. BARTON

FROM A PRODUCTION STANDPOINT, the ideal die casting die is one which consists of two blocks only, has a plane parting face, and operates on a close-inject-open-eject cycle. In practice, only a minority of castings can be produced from tools of such simple construction, and many components, by reason of their complex forms or functions, require dies embodying additional moving die-blocks, irregular parting faces, or more elaborate cycles of operation.

These three factors are listed in order of decreasing acceptability. The use of sliding cores in conjunction with a plane parting and a straightforward operating sequence hardly affects the production rate (although it tends to increase maintenance costs and down-time to some extent). Irregular parting faces do not, in general, increase the lengths of the cycle times, but the increased difficulty of keeping the die faces clean leads to intermittent inter-cycle delays, with consequent reductions in overall production rates. Any modification of the standard operating sequence, on the other hand, results in an increase in the cycle time. Even at the estimating stage, the reduction in the rate of production is thus made clear, and most die casting companies accordingly give much thought to methods of avoiding such modifications.

Of the factors likely to affect the production cycle, the most common is the need to locate inserts in the die at each shot. Among others may be mentioned the use of hand-operated cores or ejectors, and the presence in the die of loose inserts that are ejected with the casting and must be replaced at each cycle. Such loose inserts fulfil a variety of functions and it is their use—or, rather, the extent to which they can be used to advantage despite resulting increases in the nominal durations of the casting cycles—that is here discussed.

In the early days of the industry, when the machines in use were mainly hand-operated, loose die inserts were quite extensively employed. This policy was followed partly because production rates were in any case low, so that the delays involved in placing the inserts in position did not represent such large proportions of the total cycle times. More important, however, was the fact that manually-operated machines gave a better opportunity than more advanced equipment for detecting sequence errors before the metal was injected, so that the risk of damage to the tool or injury to the operator was not great.

With the introduction of power-operated, but manually controlled, machines, the results of sequence errors or incorrect location of die inserts became more dangerous and costly, and the time taken up in placing the loose pieces in the die was of proportionately greater importance with the faster operating cycle. The present tendency among designers to avoid the use of loose die inserts at almost any cost is, in fact, a result of their experiences during the 15 or 20 years during which manually-controlled, power-operated machines were mainly used.

Today, however, this type of equipment is rapidly giving place to fully-automatic machines, which operate either continuously or, more usually, on a single-cycle basis. Since the control systems of these machines distinguish between, and provide for individual timing of, a number of phases within the operating cycle, it is a simple matter to incorporate any number of fail-safe limit-switch circuits that will arrest the cycle in the event of any error in the sequence. On such a machine, the operator often has nothing to do but remove the casting and press a button to initiate the next cycle. It may therefore be possible to arrange for the insertion of a loose die insert during the cycle with little loss of time, because, with the other elements of even a complex operational sequence automatically controlled, the operator can give his full attention to the handling of the loose pieces.

Consequently, more consideration may usefully be given to the advantages of loose die inserts than has been customary in the recent past, and in the notes that follow some examples of the ways in which they can facilitate production are briefly reviewed. Although in the above discussion it has been assumed that—as is commonly thought—the effect of incorporating loose pieces is always to slow down the cycle, in some instances this result has not followed. In particular, loose

die pieces can quite frequently be utilized to facilitate the loading of cast-in inserts, and thus reduce the overall cycle times.

SOME EXAMPLES OF CAPTIVE INSERTS

It is convenient to consider together, in connection with these and other applications, both loose die inserts and captive die inserts. The latter, while ejected from the moving members together with the castings, as indicated in Fig. 1, are not removed completely from the dies. Only one captive insert is thus required where, if loose inserts were employed, it would be normal practice to provide at least three. In practice, captive inserts are used when the casting can be lifted away easily by the operator.

A very simple form of captive die insert is a quill, permanently secured to the ejector-plate, which provides a seating for a steel pin that is to form an insert in the die casting. Such an arrangement, as seen in Fig. 2, is frequently adopted when a threaded steel stud is to be cast into the end of a slender boss, since it would be difficult to locate the stud at the bottom of the cavity by hand. In these circumstances, the provision of a captive die insert may often be a simpler solution than the use of an insert loader.

A variant of the same method may be adopted when some part of the projecting portion of a cast-in insert is larger than the cross-section at the cavity intersection. A headed stud is a typical example. Although such a stud can be located simply enough if it can be disposed in the plane of the die parting, such an arrangement is not always practicable. With captive die inserts, headed studs can be positioned without difficulty.

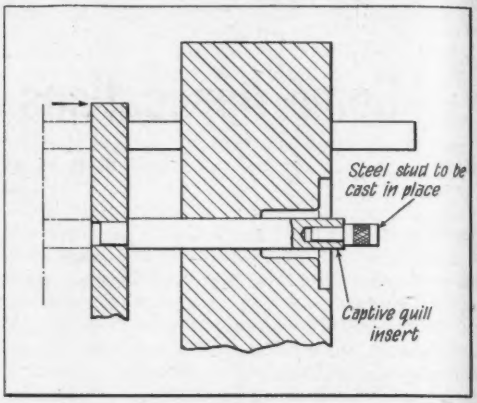


Fig. 2. A captive quill insert facilitates the location of inserts in recesses of the die cavity

As shown in Fig. 3, the die insert is split along the axis of the stud. One portion is mounted on the ejector plate in the same manner as the quill in Fig. 2, and the other is pivoted an inch or so in advance of the plate, and is fitted with a pair of tension springs disposed parallel with the plate. These springs tend to pull the two halves of the assembly apart when there is no constraint upon them. The pivoted part of the assembly is reduced in cross-section from a point a little distance to the rear of the insert-seating recess, so that when the ejector plate is advanced there is clearance in the housing for the jaw to open. In practice, it does not open until the operator twists the casting slightly, but this is not a drawback.

The mode of operation for a die so constructed will vary slightly, according to the form of the insert. If the insert will lie unsupported in the half-seating in the fixed jaw (which should always be the lower), the operator need only lay it in place and close the die in a single movement. When the return pins strike the fixed die member, the moving jaw is retracted into its housing and, the rear surface being shaped to provide a cam action, automatically clamps the insert. If, however, a very long or irregularly shaped insert is to be located, the machine

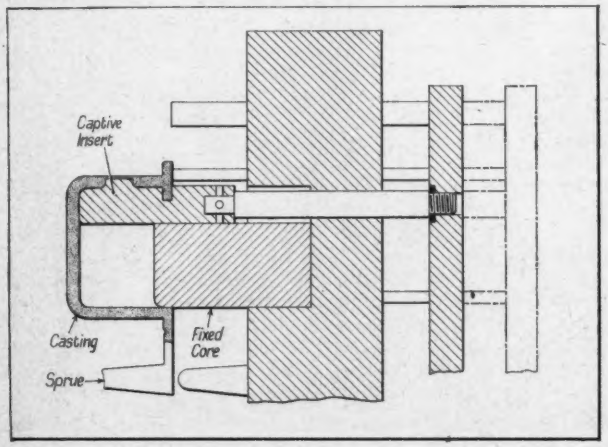


Fig. 1. A captive die insert is here used to form an interior undercut

controls are set to arrest the die movement with the die members separated by about 1½ in. The operator now places the insert in position and presses the moving jaw down on to it with a bar, at the same time advancing the moving die member. When the latter again stops, before closure, he withdraws the bar, the jaws then being retracted sufficiently for firm clamping. Finally, the die is closed and locked.

Many variations on this basic arrangement may be adopted, and it lends itself well to the positioning of inserts where the axes are not parallel to the direction of die movement. Transverse inserts with both ends anchored, as in the example shown in Fig. 4, are most easily located in this manner, the captive die pieces then serving also to core the space around the insert. For such an application, positive displacement of at least one of the jaws is necessary, and this result can best be achieved by providing a cam block that contacts the rear end of the moving jaw before the end of the ejector stroke.

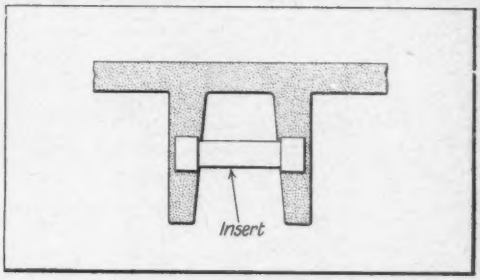


Fig. 4. To grip this transverse pin insert, which is anchored at both ends in the casting, an arrangement similar to that shown in Fig. 3. is used

COLLET-TYPE CAPTIVE INSERTS

Captive die pieces of collet type, with both jaws free to move when the ejectors are advanced, are not, in general, so well adapted to insert location as the types already described. They are useful, however, for producing slightly undercut features, such as small-diameter screw threads. Their application for this purpose has been described elsewhere.*

In one instance, a captive collet was effectively employed to solve a gating problem. The component was of circular form with a large, tapered central bore and a thin web. As the taper was functional, the direction of draft was predetermined. On the side of the web adjacent to the small end of the bore there were two heavy bosses, the solidity of which was critical. As is well known, it is difficult to avoid porosity in local heavy sections except by gating into them, and in this case there was no obvious method of so doing.

The solution adopted is illustrated by the sectional view in Fig. 5. A core which forms the tapered bore is housed in the fixed die member and the sprue hole is bored through it. Opposite to the core, in the moving die member, there is a captive collet which forms the central portion of the web surface, and the two boss cavities are located at the joint line of this collet. The end of the fixed core abuts directly on the centre of the collet when the die is closed. In line with the sprue hole, a slightly smaller hole is bored in the split of the collet, and from this hole two lateral runner channels are cut in the collet parting faces and are gated to the two bosses.

The collet halves are mounted on rods that pivot in a double trunnion mounting secured to the ejector-plate. These rods pass through a hole in the die block slightly smaller than the collet diameter. When the casting is fully ejected, the collet halves are still closed, and the operator inserts a flat bar between the rods immediately behind the collet as indicated in the lower sketch. He then twists the bar to separate the two jaws while holding the projecting sprue with tongs.

* H. K. and L. C. Barton. *Diecasting Die Design.* MACHINERY Publishing Co., Ltd., Standard Reference Series, p. 91.

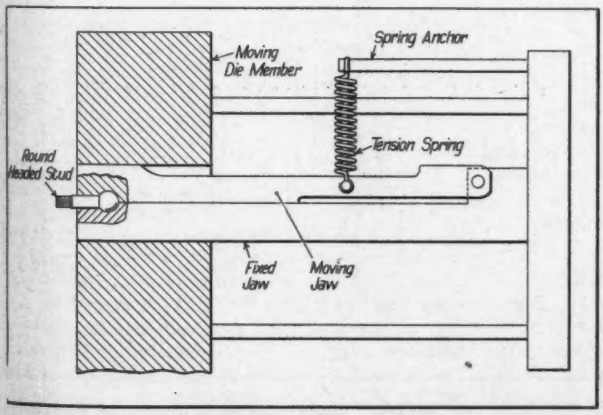


Fig. 3. A captive die insert with one moving jaw, which is used to locate a ball-headed pin

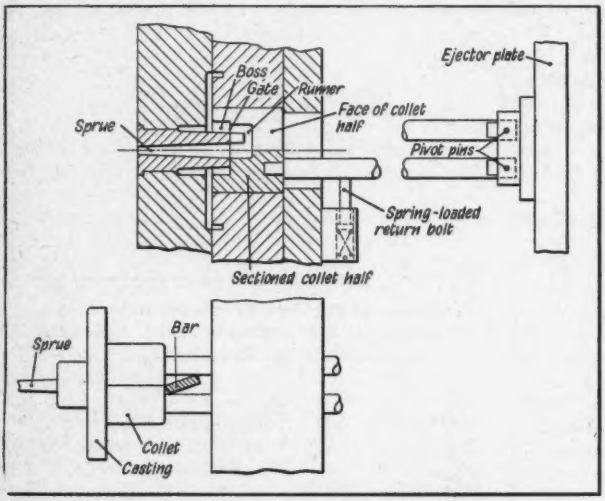


Fig. 5. A split collet located opposite to the sprue hole enables the runner to be carried through and under the casting to feed into two heavy bosses. The lower sketch shows how the operator separates the halves of the collet

After removal of the casting, the bar is withdrawn, and the two spring-loaded bolts seen in the figure, which engage the sides of the hinged rods, return the collet to the closed position and align it with the housing in the die block.

In this tool, the distinction between captive die inserts and collapsible coring is becoming tenuous, but although the inserts perform a function that, with a casting of different form, might be fulfilled by sliding blocks, the mechanical operation is essentially similar to that of the simpler captive insert arrangements already described. Like them, it would operate just as effectively if the connection with the ejector plate were eliminated and the die inserts ejected with the casting to be subsequently removed—*i.e.*, if they were loose instead of captive.

LOOSE INSERTS OF "PILL-BOX" AND ANNULAR TYPES

Loose die inserts, however, have a much wider range of application than the captive types, primarily because they can be housed in either die block, whereas for practical purposes captive die inserts can only be fitted in the moving member. The simplest type of loose insert is the "pill-box" form which, as indicated in Fig. 6, is used to produce small-diameter threads without a split. After the casting has been removed from the die, the pill-box is unscrewed with a nut-runner.

Loose inserts of annular form also have a wide field of usefulness. They, too, are employed for forming threads without a split, often when the thread is required on an intermediate diameter of a component and the smaller portion could not be rotated for withdrawal from a deeper cavity insert. Ring inserts can also be used with advantage for loading rotor laminations. It is easier to locate these laminations correctly in a separate ring on the bench than to place them directly in the die. An additional advantage is that the ejection of the casting is greatly facilitated. The ring holding the casting is pushed from the die without difficulty, whereas a much greater thrust would be needed to eject the rotor directly from a cavity in the die block. A power press can then be used to

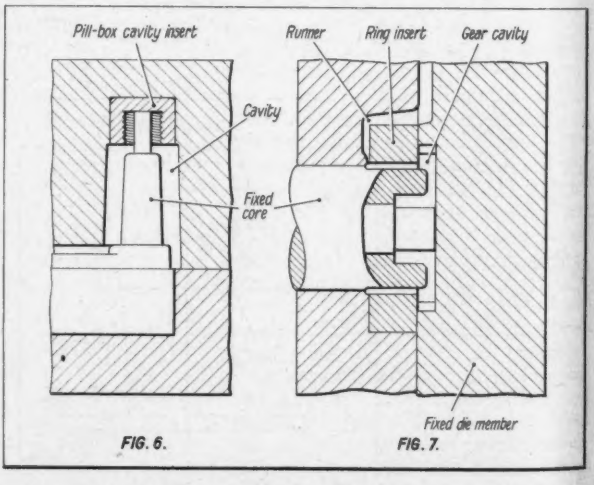


Fig. 6. A "pill-box" cavity insert forms a thread on the end of a boss, and is unscrewed from the casting after ejection
Fig. 7. By using a loose ring insert, gating into the edge of this gear cavity is avoided

push the rotor out of the annular die insert.

A valuable feature of a ring insert is that it provides an alternative gating line on the component. This feature is useful when, for example, an unshrouded gear is to be formed (Fig. 7) at the largest diameter of a die casting. To gate into the teeth is usually undesirable, and to gate into the side-face would necessitate a machining operation. By using an annular die insert which is ejected with the casting—the outer diameter of the insert being larger than the gear—it is possible to carry the runner under the insert and gate into the skirt. Here, again, the casting is pushed out of the ring under a press, the sprue metal being broken away first.

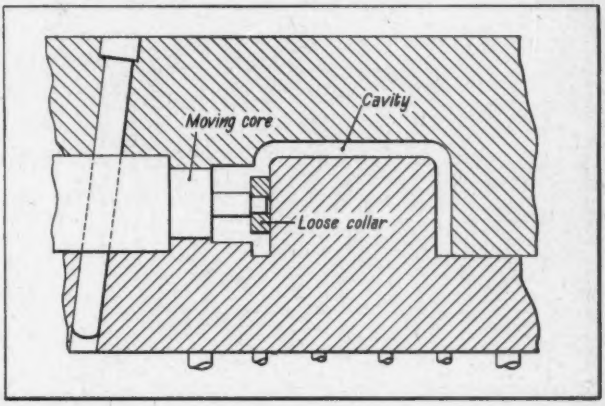


Fig. 8. A loose collar pushed over the end of the moving core here forms a recess in the inner wall of the die casting

In the foregoing examples, the loose inserts form parts of the exterior surfaces, but interior surfaces may often be formed more easily by using loose die parts than in any other way. An example is a component with a helically splined bore. Although it is sometimes possible to rotate the component through the required angle during ejection, and thus twist it out of the cavity, or to arrange for the contra-rotation of the core while the casting is ejected without being twisted, each of these methods results in a slow production cycle and necessitates a complex die.

USE OF A LOOSE COLLAR FOR FORMING SPLINES AND INTERNAL RECESSES

Faster operation and a cheaper die are obtained by forming the splines in a loose sleeve which is slipped over the core, and ejected with the casting. The sleeve is then pressed out, by using a punch with a freely-rotatable tip backed by a thrust-bearing. The casting only requires to be so located as to prevent rotation if the punch is caused to turn positively as it descends. With a freely-turning punch (which suffices if a twist of only a few degrees is required) there is no reactive torque.

A loose sleeve or collar may also be used in conjunction with a moving core when a larger diameter must be formed by the inner end of the core than the outer. For example, as shown in Fig. 8, it may be required to form a hollow boss on the side of a box-like component. This result can be obtained very simply, and with little interruption to the operating cycle, by reducing the diameter of the lateral core and placing over it a collar which, when the die is closed, is pressed hard against the side of the main core. The lateral core is retracted in the usual manner, as the die opens, leaving the collar in place within the casting, which is dropped over a simple fixture while a punch, operated by an air-cylinder, drives the collar out of the boss. In the example illustrated, the collar is of plain circular form, but if provision is made for positive location on the moving core, a non-circular recess can readily be formed in the same manner.

It might, in favourable circumstances, be possible to produce a casting of the form shown in Fig. 8 by making a lateral core which is retracted into the main core. Such mechanisms are practicable in dies used for zinc and the low melting point alloys, but not, in general, in those used for casting aluminium or magnesium. The provision of a loose collar is likely to prove the better solution whatever the alloy group. Moreover, in many instances loose die inserts offer the only possible means of producing a casting of the requisite form, moving cores and other devices being ruled out for one reason or another.

GREATER ACCURACY OBTAINABLE WITH LOOSE CORE PLUGS

A point to be borne in mind is that, where there is a choice between the use of a moving core and a loose die piece, the latter may provide greater dimensional accuracy as well as operational simplicity. This statement applies particularly in those instances where a loose core plug is used instead of a moving core located at the die parting. Since the core slides axially, clearance must be allowed wherever it might rub against any part of

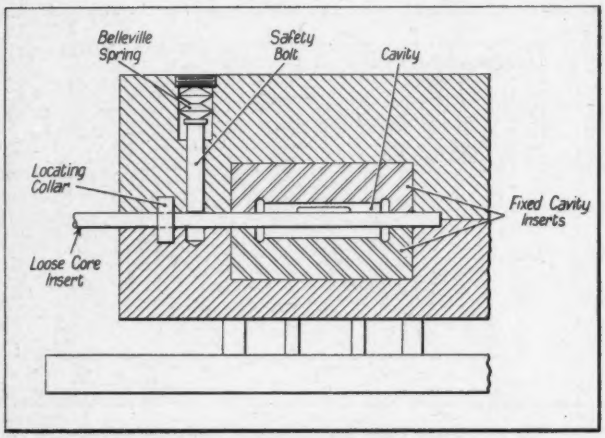


Fig. 9. A simple type of loose core insert

the cavity surface, where it is anchored in the die (if it is a core for a through hole), and in the slide housing.

A loose core plug, by contrast, is located by moving it sideways into its housing in the die face, and can be brought into firm contact with any projecting parts of the cavity, if necessary, without risk of galling. Whether it is located at one or both ends, no clearance is necessary in the housing and closer dimensional accuracy—as well as less likelihood of flash formation—can thus be ensured.

Often, the simplest method of using a loose core, instead of one that is mechanically operated, is that shown in Fig. 9, where the core element is a long steel rod projecting from the die and fitted with a handle. Location is provided by a brazed-on collar which enters recesses in the die face. To ensure correct axial positioning of the slightly tapered working end of the core, the collar is made overlength before it is brazed in position and is subsequently faced.

In the example shown, the use of a loose insert instead of a moving core enables a component with a deep bore, but of no great weight or projected area, to be die cast on a small semi-automatic air-operated machine. To pull the long core mechanically would hardly be practicable with the stroke and power available, and any sort of withdrawal mechanism would greatly complicate the die. The casting is stripped from the rod in a fixture adjoining the machine, the locating collar providing purchase for the stripper yoke. A foot-operated lever serves to "break" the core from the casting and withdraw it for about ¼ in., after which an air-cylinder pulls it clear.

The main drawback to the use of a hand-operated core projecting from a die is that, should the rod be inadvertently omitted, injected metal can escape along the housing. Although such an occurrence can be prevented in production by including in the control circuit a limit switch, which is closed only when the rod is in position, there would still be danger when the machine was under manual control during setting-up. Such a die, therefore, should always be fitted with a spring-loaded plunger, as shown, which completely blocks off the seating if the rod is not in place.

For larger dies, and with larger diameter cores, it is invariably preferable to provide short core inserts which are completely enclosed. The omission of an insert is not then a source of immediate danger, although the operator—who will know by the way the injection plunger moves if he has omitted to insert the core—should arrest the operating cycle immediately, to allow the heavy mass of metal filling the core-space to solidify before opening the die.

A loose core is used in the die shown in Fig. 10, which produces a tubular component with integral brackets (not seen in this view) and two cross-holes. It would be possible, on the machine used for this

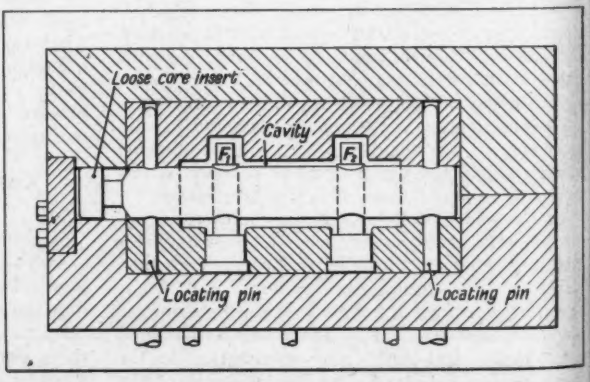


Fig. 10. A loose core insert is often preferable to a conventional moving core when the use of intersecting cores is unavoidable

casting, to pull the main core without difficulty, but it would then be necessary to provide moving cores for the cross-holes also, instead of the fixed cores F_1 and F_2 seen in the figure. For this purpose, the die cavity would require to be turned through 90 deg., to enable the secondary cores to be placed in the parting plane, and the change would make it more difficult to cast the integral brackets.

The main objection to using a conventional moving core in this case, however, is the likelihood of small variations in its axial position when advanced for casting, since the slightest error in this respect would result in galling when the secondary cores were advanced. The risk of such damage, indeed, is one of the principal reasons why the use of intersecting cores is considered bad design practice.

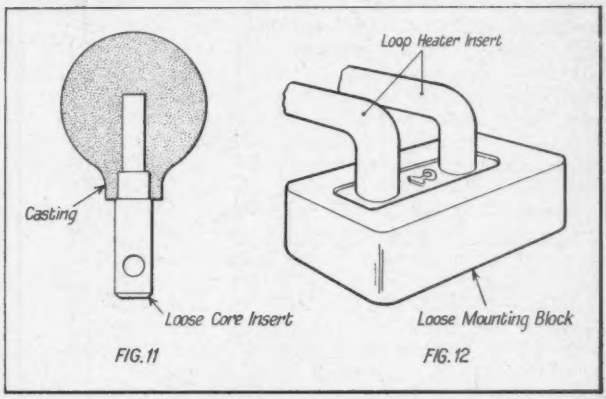


Fig. 11. By ejecting a heavy-section casting with the core still in place, the operating cycle time may be considerably reduced. Fig. 12. A tubular heating element is here anchored in a small mounting block to facilitate location in the die

If only a single cross-hole is required, it is possible to avoid the need for passing one core through another, but with two cross-holes the undesirable features of such an arrangement have to be accepted. The loose core insert is, however, inherently superior to a conventional core. It can be positioned axially with greater accuracy, and because it operates at a lower temperature, it is less likely to gall the secondary cores. Where the latter are fixed, as in Fig. 10, it is desirable to provide dowels longer than the cores, to assist in loading the core insert, which is placed over the ends, and pushed back into correct casting position as the die closes. It is not advisable to use the transverse dowel holes for stripping the core, as is sometimes done. Either an additional hole should be provided, through which a pin can be passed to link the core insert to a clevis on the stripping ram, or—preferably—the larger end of the loose core should be grooved, as is the example illustrated, so that it can be dropped into a yoke. Short core inserts can be driven out under a press.

LOOSE CORES FOR HEAVY CASTING SECTIONS

An application of a loose core insert which is often overlooked by designers is shown in Fig. 11, where an ejectable core is used to form a deep hole in a very heavy section of a casting. Here there would be no difficulty in ejecting the part from a fixed core, but a very long dwell period for solidification would be necessary. If the casting were withdrawn from the core too soon, molten metal would burst through the bottom of the hole and partly fill the bore. For a casting of such heavy section as that shown, the necessary dwell period might be longer than the whole of the remainder of the cycle, and faster operation is achieved by using the ejectable core. If the casting is of simple form, it may be practicable to fit a stripping device to the top or near side of the die. The operator then drops the casting into the fixture as soon as he has closed the die, and the core is pulled out during the next opening stroke of the machine cycle.

USE OF LOOSE DIE MEMBERS FOR LOCATING CASTING INSERTS

Loose die inserts, like captive inserts, may be used to facilitate the location of items that are to be cast in position in a component. This procedure is most likely to offer advantages when the part to be located in the die is of a springy nature and needs to be anchored at more than one point, and when studs are to be cast-in with their axes normal to the direction of die movement.

An example of the first type of application is the location of tubular heating elements in griddles and electric-iron sole-plates. These elements are normally of loop form, with the ends brought close together and bent at right angles. The ends, which must project from the die casting, are pushed into holes in the cavity. If these holes are bored directly in the die block, however, they are not readily accessible to the operator, and time is wasted in loading the insert and check-

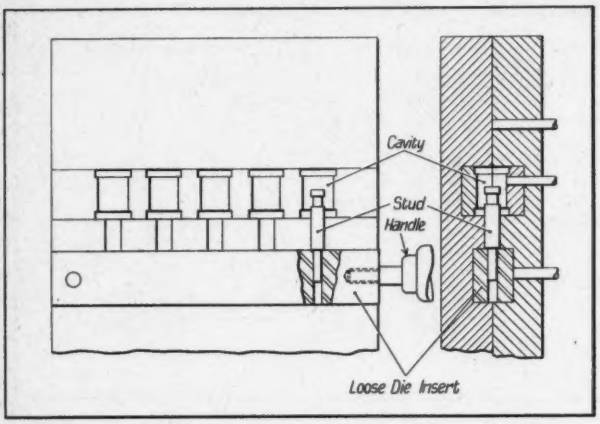


Fig. 13. A method of locating small steel studs in a multi-cavity die

ing that both ends have been pushed right home.

It is preferable, therefore, to provide a small separate block, as seen in Fig. 12, into which the ends of the heating element are pushed, before the whole assembly is placed in the die. With this method, the location holes can be a closer fit for the tube ends, and accuracy of positioning is improved. The operator has plenty of time, after closing the die, to load the next insert, and the location of the block in the die requires appreciably less time than the loading of an unmounted heating element.

Studs with their axes at right angles to the direction of ejection can often be located most easily by means of a sliding core-block provided with a quill or quills. The block is withdrawn prior to ejection, to leave the casting free to be pushed off the die face, and it is usually possible to arrange for it to be moved back sufficiently far to enable loading to be carried out fairly conveniently. This method is most effective when only one or two studs are to be cast-in, and when they can be located in the plane of the die parting.

If a larger number of studs is to be loaded at each cycle, it will probably be more efficient to pre-load them into a loose die insert. Where all the studs are to be located at the die parting of a multi-impression tool, a loose steel bar can be housed in slots extending right across both die faces, as in Fig. 13. This bar is bored on the cavity centres to accept the insert shanks, but—and this applies in most cases where loose die inserts are employed—it is a good plan to provide a blank bar that can be placed in the die during set-up to enable the setter to run the machine without loading a set of studs each time.

When a set of studs is to be cast-in on the side wall of a die casting it is sometimes better to locate them in a loose insert which fits into a pocket in the fixed die member, than to use a moving core. If the projected area to be formed is large, the thrust against a moving core, as in the example in Fig. 14, is so great that an unwieldy wedge-lock must be built into the die, and even then it may prove difficult to hold dimensions closely. Moreover, unless the core has a very long stroke, which, in turn, introduces more problems, location of the studs is still likely to be difficult. This trouble may sometimes be overcome, as indicated in the figure, by providing a magazine feed.

LOOSE INSERT FOR LOADING STUDS

A smaller and stronger die, with much less risk of mechanical failure, can, however, be provided by adopting the construction shown in Fig. 15. Here, the studs are loaded into the loose insert

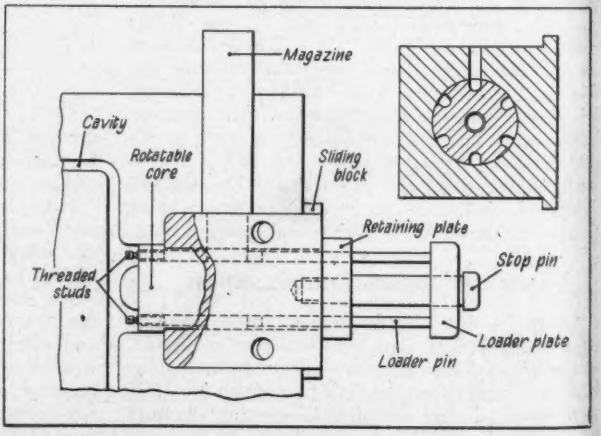


Fig. 14. Studs are here located in a lateral sliding core. The difficulty of loading them by hand is avoided by the provision of a magazine feed

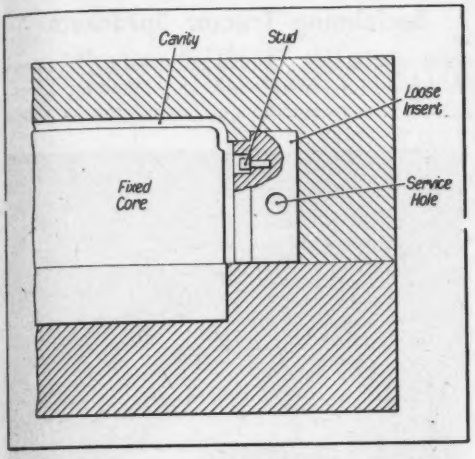


Fig. 15. A loose die insert which forms a panel in the side of a casting is easily loaded with studs after it has been removed from the die

before the latter is placed in the die. The loose die piece is of exactly the same shape as the working end of the core that it replaces. In other words, it is made deeper and wider than the area on the side of the casting that is to be formed, and carries a projecting panel to produce the required surface of the casting. With this arrangement, the flash is formed at right angles to the casting surface and the tendency to wedge, that arises when flash can enter the housing, is thereby avoided.

ADVANTAGES OF SPRUE PLUG INSERTS

An application of loose die inserts, that is now proving of value in connection with the production of large aluminium die castings on cold chamber machines, involves the use of sprue plugs, to enable useful modifications to be made to conventional cold chamber gating methods. Broadly, the provision of sprue plugs serves, in some measure, to bridge the gap between the gating methods possible with Polak-type machines and those that can be employed with the more widely-used (in the West) horizontal cold-chamber types.

With the latter, the runner metal terminates in a disc or slug of relatively large diameter, whereas a casting from a Polak type machine has a long, slender sprue, similar to that produced with a gooseneck-type machine, as used for casting zinc. The size, and considerable heat content, of the slug from a horizontal machine has a marked—often, a critical—influence on the location of the die cavity in relation to the shot sleeve. In particular, it precludes the use of internal gating unless the casting has a hole of 3 or 4 in. diameter at an appropriate position.

By the use of a sprue plug, it is possible to gate a casting internally at a much wider choice of positions—almost anywhere, in fact, within about a 3-in. radius of a cored hole of not less than ¾-in. diameter. A core of at least this size is needed to support the plug. The method, in one of its simplest forms, is illustrated in Fig. 16.

The casting in question has a central boss with a heavy wall section, and this boss is aligned with the shot sleeve. At the forward end, the sleeve is increased in diameter to receive the sprue plug, which is held in position, when the die is closed, by the end of the fixed core for the bore in the boss. A runner channel is cut in the side of the plug, and terminates in a shallow gate which, as may be seen, leads into the periphery of the boss.

At injection, metal is forced along the runner into the cavity, and a slug is left between the end face of the plug and the plunger. On opening the die, the plug comes away with the casting and is ejected with it. The slug is then knocked off, the runner being broken at the gate, and the plug can be removed from the casting. If the cavity face of the plug forms only a flat face on

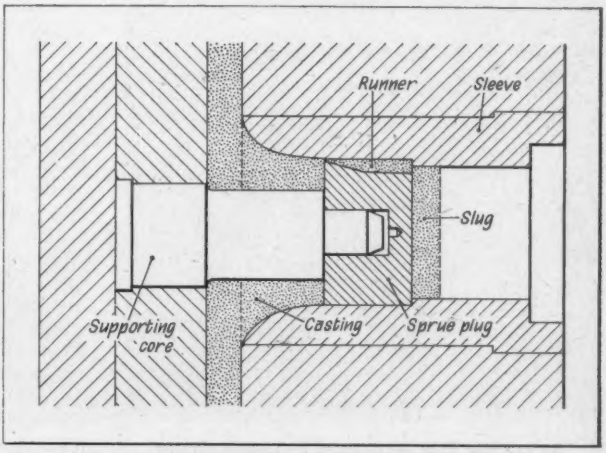


Fig. 16. This loose "sprue plug" provides a means of gating into the edge of the heavy-walled boss

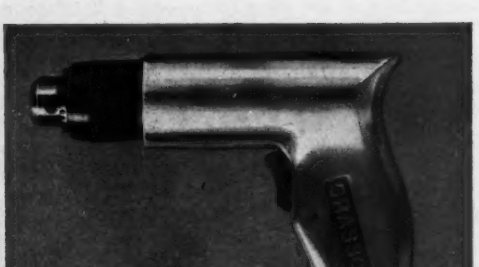
the end of the boss, as in the figure, no fixture is needed to separate the plug from the casting.

The same method can be used for a casting which has only a small boss, or no boss at all, provided that there is a core of sufficient strength to support the plug. Thus, the cavity face of the plug may form an area—preferably an area defined by some change of contour—of a casting of relatively thin and even section. In such circumstances it is usually preferable to feed direct—without the constricted gate seen in Fig. 16—into the web of the casting.

Morrisflex-Grasso B. 12 Series Pneumatic Drills

B. O. Morris, Ltd., Morrisflex Works, Briton Road, Coventry, are marketing in this country the Grasso range of portable pneumatic drills which are made in Holland. A typical drill is here illustrated, and it will be seen that it has a pistol grip and control trigger, and that the chuck is shrouded for safety, and for silent operation.

There are two drills of ¼-in. capacity, designated type B. 12/30 and type B. 12/41. The former tool runs at a speed of 3,000 r.p.m. and the latter at 4,100 r.p.m. For drilling stainless steels and Nimonic alloys, slow speed tools fitted with $\frac{1}{16}$-in. capacity chucks are available. These tools comprise the types B. 12/4, B. 12/6, B. 12/8 and B. 12/10, with speeds of 400, 600, 800, and 1,000 r.p.m., respectively.



An example from the range of Dutch-built Grasso portable pneumatic drills which are marketed by B. O. Morris, Ltd.

Reclaiming Tractor Sprockets

Caterpillar tractor service provided by H. Leverton & Co., Ltd., Westlode Street, Spalding, Lincs., includes the reclamation of tracks, grouser shoes,

Reclaiming a Caterpillar tractor sprocket by welding on a rim with Opal electrodes

rollers, idlers, and sprockets. An effective method of reclaiming worn driving sprockets involves cutting off the entire rim, and welding a new rim to the spokes. Since the entire torque output of the tractor is transmitted through these spokes, welds of high quality and strength are necessary.

The sprocket is clamped to a flat jig plate provided with a centring boss and an adjustable, radial arm whereon is mounted a cutting torch. A 30-deg. chamfer is produced on each spoke at the cutting operation. After slag has been removed from the arms, and paint from the welding lugs of the new rim, the two parts are set up square and concentric on a stand, as shown in the illustration. The first tack welds are made with 8-gauge Opal electrodes supplied by Cooper & Turner, Ltd., Vulcan Road, Sheffield, 9, to penetrate to the roots of the vees.

Root and subsequent runs are made with 6-gauge Diadem Opal electrodes, and are carried out in staggered numerical order. Up to 12 runs may be required on the larger sprockets. While the welds are still hot, they are lightly peened with a hammer to reduce welding stress. After completion of this stage, the sprocket is reversed on the stand and the butt welds on the opposite side are made.

Churchill Fully-automatic Production Line for Layshaft Cluster Gears

A FULLY-AUTOMATIC MACHINE LINE which has recently been completed by Churchill Gear Machines, Ltd., Blaydon, Co. Durham, for the production of layshaft cluster gears for gearboxes for Austin Seven cars, is basically similar to that built by the company some two years ago (see MACHINERY, 93/1017—29/10/58), but it has a larger productive capacity, and the individual machines and the work-handling arrangement incorporate some recent design improvements.

The layshaft cluster handled on the new line, which is 200 ft. long, has three helical gears with 28, 24 and 19 teeth of 13·054 d.p., and a spur gear with 13 teeth of 10 d.p., and the operations performed comprise hobbing, gear shaping, tooth chamfering, tooth rounding, shaving and plunge grinding. In all there is a total of 23 machines in the line, including eight Churchill Rigidhobbers, and five Fellows-England type 7125 A gear shaping machines (Alfred Herbert, Ltd.), and 4,500 layshaft cluster gears are produced in a period of 70 hours at 100 per cent efficiency. It will be recalled that in the earlier line there are five Rigidhobbers and three Fellows-England gear shapers, and that cluster gears are produced at the rate of 3,500 in a 70-hour period.

Of the Rigidhobbers in the new line, three are employed for cutting the 28-tooth 4th speed gear of the cluster, three for cutting the 24-tooth 3rd speed gear, and the remainder for the 13-tooth spur gear. The gear shaping machines provide for cutting the 19-tooth 2nd speed helical gear. Fig. 1 is a view of the line from a point close to the fourth gear shaping machine, looking towards the starting end.

Blanks for layshaft clusters are turned from En. 351, 0·75 per cent Ni. Cr. steel forgings at a previous operation, and after they have been washed and dried, the part number is stamped on each piece. Next, the blanks are raised by an elevator to a checking position, and then passed, by way of another elevator, on to the central track on a continuously-moving slat-type conveyor which extends in front of the line of Rigidhobbers and has an overall length of 54 ft. When starting up, the blanks are passed to the first Rigidhobber in the line for cutting the 4th speed gear, where a small storage bank is built up. As further pieces are loaded on to the conveyor, they are deflected to the outer track, and subsequently returned to the central track, to be passed to the second machine in the line, where, again, a storage bank is formed. When this bank has been built up, blanks are once more deflected, to be directed to the third machine.

On reaching a machine, a blank moves into a pivoted pre-loading arm as seen at *A* in the close-

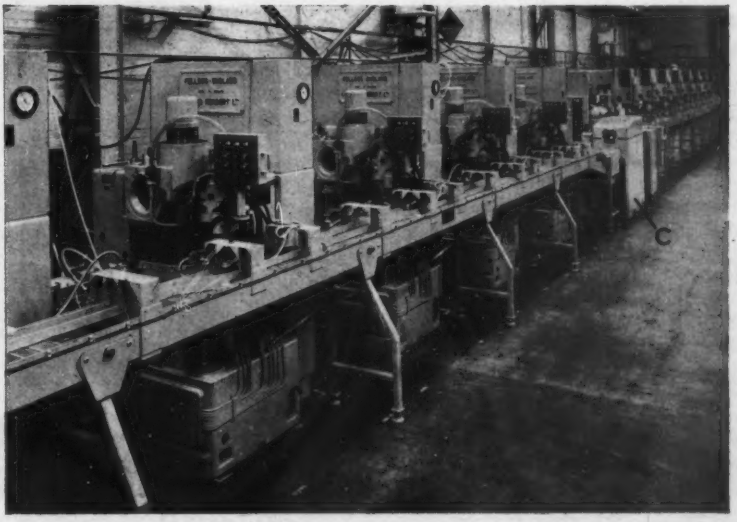


Fig. 1. View of the Churchill fully-automatic gear production line from a point close to one of the Fellows-England gear shaping machines and looking towards the starting end

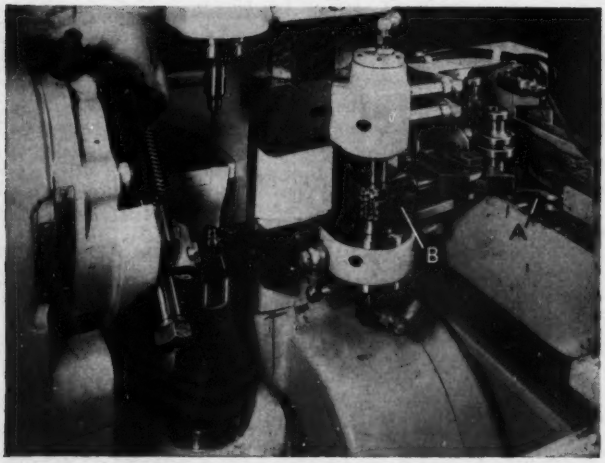


Fig. 2. Close-up view of part of the conveyor, and the hydraulically-operated loading arm for one of the Rigidhobber gear hobbing machines

up view Fig. 2, which swings over to present the piece to the hydraulically-operated loading unit *B* on the machine. This unit is of a standard type developed for use on Rigidhobbers, of which full details were given in MACHINERY, 90/940—20/4/57. When the jaws at the outer end have closed to grip the blank, the loader rises, swings in a clockwise direction, and lowers the piece into the cutting position on the machine. At the end of a pre-set dwell period, the pre-loading arm *A* is returned to its original position on the central track on the conveyor.

The hobbed component, deposited on the inner track by the loading unit *B*, is moved until it meets an air-operated safety gate, and, when released, it by-passes the second machine in the line, and is brought into contact with another safety gate. On being released by this gate, the component by-passes the third machine in the line, but is diverted to the central track for feeding the next three machines which cut the 3rd speed gear. After this operation has been completed, the same procedure is repeated for transporting the workpieces to the last two Rigidhobbers in the line, for cutting the 1st speed spur gear. The outer track on the conveyor accommodates components which by-pass a storage bank at any hobbing station, and pass to the next machine.

Hobbing is carried out in a cycle time of 1 min. 45 sec. for the 4th speed gear, 1 min. 30 sec. for the 3rd speed gear, and 1 min. 15 sec. for the 1st speed gear, and loading and unloading of the workpieces occupies 15 sec. The hobs are run at a speed of 310 r.p.m., and a feed of 0·060 in. per rev. is employed. Continuous shift, at the rate of 0·00002 in. per hob-rev., is applied to each hob slide for a maximum distance of 2½ in., and some 250 working cycles are completed before it becomes necessary to sharpen the hob. During grinding, 0·010 in. of metal is removed from the hob, which can be sharpened 20 times before it is discarded. Oil mist lubrication for the main driving gears has recently been provided on the Rigidhobber machine, and the slides are lubricated by a single-shot system. Another new design feature is the provision of a disc brake for the rapid traverse motor.

When the 4th, 3rd, and 1st speed gears have been hobbed, the partly completed clusters are discharged from the left-hand end of the first conveyor at ½-min. intervals, under the control of another air-operated safety gate. As each gear moves down the inclined end of the conveyor, it passes between two cylindrical guide bars, and is turned through 90 deg. by gravity,

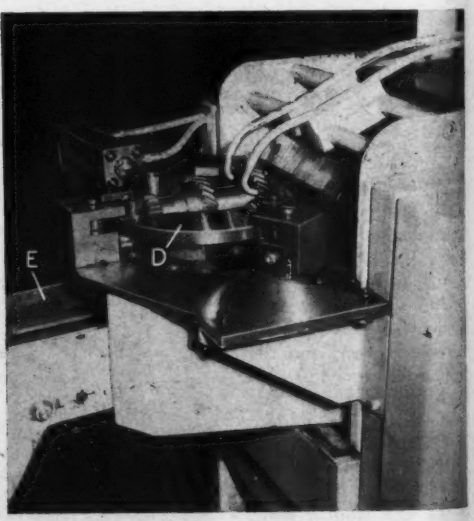


Fig. 3. This unit, attached to the left-hand end of the first conveyor, provides for turning layshaft cluster gears through 90 deg. in the horizontal plane, in readiness for delivery to a washing unit

to be delivered horizontally into an opening in a circular plate shown at *D* in the close-up view Fig. 3, which forms part of a turn-round unit attached to the conveyor. The gear then rests on the top edges of two partly-circular plates mounted beneath the plate *D*, and dwells in this position for about 30 sec., so that cutting oil on its surfaces can drain away. At the end of the dwell period, the plate *D*, the lower surface and periphery of which run on steel rollers, is indexed through 90 deg. from the position shown, by an air cylinder at the rear. The gear then falls between the ends of the support plates, and through a slot in the base of the attachment, to be discharged on to the inclined guide rails at *E*, for delivery to a conveyorized washing and drying unit of Churchill design, indicated at *C* in Fig. 1. The air cylinder and the safety stop, it may be noted, are controlled by valves operated by a cam on the driving shaft for the conveyor.

A gear is delivered from the washing unit every 35 sec., by way of other inclined guide rails, and at the lower end, it overbalances, and is passed by way of a spring-loaded platform, to be discharged with its axis vertical on to a 35-ft. long slat-type conveyor which feeds the gear shaping machines. In contrast to the arrangement on the earlier machine line, there is no provision for automatic gauging of the gears following washing, this operation being performed manually by setter control-inspectors.

The conveyor for feeding the gear shapers is of similar design to that employed with the Rigid-hobbers, and provides for workpieces to be deflected to by-pass storage units at the individual machines. Both conveyors have an operating speed of 6 ft. per min. Loading and unloading of components at the beginning and the end of the gear shaping cycle are carried out by hydraulically-operated attachments, which, again, are of similar design to those provided on the hobbing machines. Gear shaping is carried out in a cycle time of 4 min. 21 sec., and the cutter spindle is reciprocated at a speed of 417 strokes per min. When gear shaping has been completed, the gear is turned through 90 deg., and passed to the second washing unit in the line by way of another arrangement, similar to that shown in Fig. 3.

TOOTH CHAMFERING, ROUNDING AND SHAVING OPERATIONS

From the second washing unit, each cluster is delivered to three Churchill machines in turn, which provide for cutting chamfers on the ends of the helical gears. For this operation, the cluster is held horizontally between a pair of air-operated centres, one of which is actuated by a larger air cylinder than the other, and provides for endwise location. Chamfering, to remove acute edges on both ends of the gear teeth, is performed with rotating disc-type cutters, which are moved downwards into full engagement with the gear under controlled pressure, after which the head is traversed, first to the left and then to the right, through a distance of 0·030 in., by compressed air. The cutter spindle is driven at a speed of 100 r.p.m. by a 1-h.p. motor, and the cycle time for chamfering one gear is 22 sec.

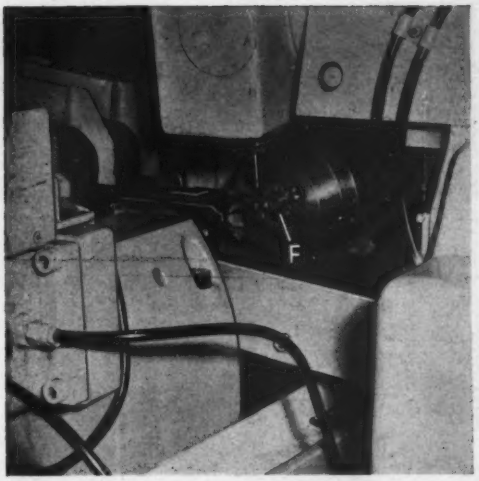


Fig. 4. For tooth rounding operations, the layshaft cluster is driven by the pinion *F*, which meshes with the gear on which machining is to be carried out by the pencil-type cutter

Tooth rounding is next carried out on both ends of the 1st speed gear by separate Churchill machines, and a close-up view of the cutter and the work-head on one of these machines is given in Fig. 4. For tooth rounding, the cluster is held between air-operated centres in the work-head and tailstock, and is rotated by the gear *F*, on the work-head, which meshes with the gear on which the cutting operation is to be performed. At the same time, the table is reciprocated by cam action in a direction parallel with the work axis, to impart the required movement to the cluster, in relation to the vertical pencil-type cutter, for performing the tooth rounding operation. A 1-h.p. motor drives the cutter spindle at a speed of 1,050 r.p.m., and the cycle time for each machine is 30 sec.

Following a third washing operation, the clusters are de-burred by hand, and are then passed to four Churchill type F.A.U. gear shaving machines

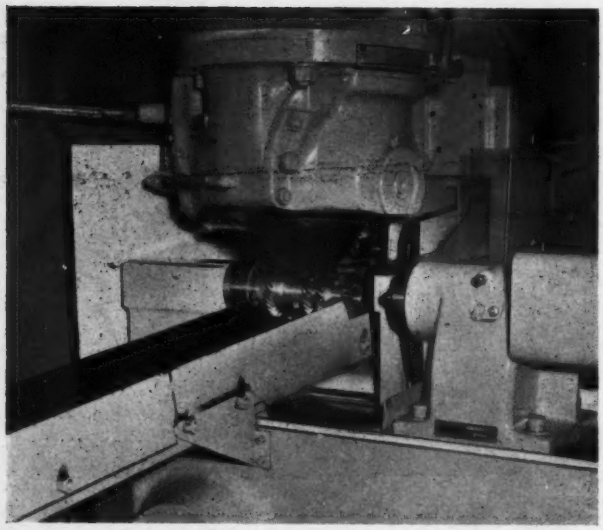


Fig. 5. In this close-up view, a layshaft cluster has been brought to the cutting position by the loading fingers

(MACHINERY, 96/1529—22/6/60 and 97/169—20/7/60), each of which provides for taking a cut on one gear. As may be seen in Fig. 5, which gives a close-up view of one of the gear shavers, the table is turned through 90 deg. as compared with the normal arrangement, to provide for straight-line loading. Crossed axis shaving is carried out with a 9-in. diameter differentially-serrated cutter, which is set at an angle of 80 deg. to the work axis, and the table feed is 2·83 in. per min. Feed is applied upwards to the table in increments of 0·015, 0·003, and 0·002 in. at successive passes, followed by a pass without feed, and at this stage tooth thickness is reduced by 0·003 in. The cycle time for shaving is 42 sec. for the 4th speed gear, 38 sec. for the 3rd speed gear, 32 sec. for the 2nd speed gear, and 28 sec. for the 1st speed gear.

When layshaft clusters have been discharged from each machine following gear chamfering, tooth rounding, or gear shaving, they roll down inclined guide rails to be delivered to an elevator, whereby they are raised and passed to a second pair of inclined guideways for delivery to the next machine. On the earlier machine line, a swinging arm is provided for transferring clusters from the lower end of one pair of guide rails to the upper end of the next pair. One of the elevators mounted on the shop floor between two gear shaving machines is shown at *G* in Fig. 6. The photograph for this illustration was taken when the machine line was set up for demonstration at the showrooms of Charles Churchill & Co., Ltd., Coventry Road, Birmingham, 25, who are the distributors for Churchill Gear Machines, Ltd., and it should be pointed out that, in practice, the gear shaving machines would be positioned further apart than is here shown, and longer guide rails would be provided at either end of the elevator.

The guide rails serve for storing partly-completed clusters, and there is a micro-switch at the upper end, which is closed to stop the preceding machine when the maximum number is accommodated. Loading is carried out by two pairs of fingers mounted beneath the guide rails,

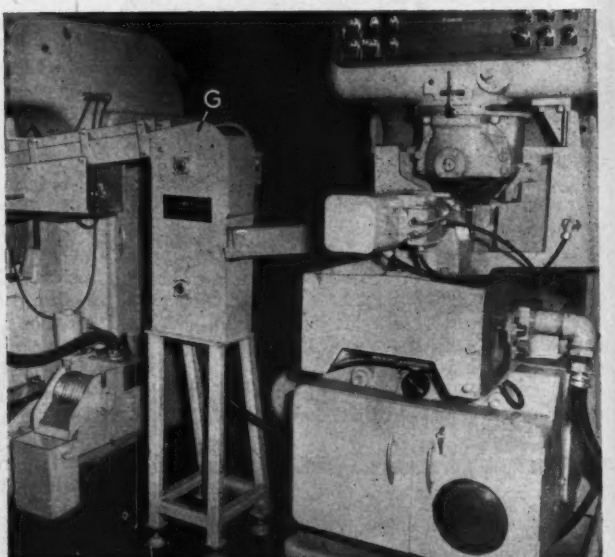


Fig. 6. View showing one of the elevators and guide rails for transporting clusters between two gear shaving machines

which grip the component at plain portions between the gears, and are advanced by an air cylinder on each gear chamfering and tooth rounding machine, and by a hydraulic cylinder on each gear shaving machine. The cluster seen in Fig. 5 has been brought to the cutting position on one of the gear shaving machines by means of the fingers, and at the next stage in the cycle, the work-holding centres are advanced into engagement with the workpiece, whereupon the fingers are moved clear.

After the clusters have been washed for the fourth time, following gear shaving, they are passed down other guide rails to a pre-loading position in front of a Newall type LA cylindrical grinder, which is set up for plunge grinding the peripheries of the 4th, 3rd, and 2nd speed gears, in a cycle time of 30 sec. From the pre-loading position, the clusters are swung, in turn, to the grinding position between the work-head and tailstock centres, by the action of a swivel-type loading unit mounted on the Newall machine. At the end of the grinding cycle, which completes the sequence of operations on the production line, the tailstock centre is retracted, and the component rolls down a curved track clear of the machine. The Newall grinder and the work-loading and unloading arrangement are of similar design to those employed on the earlier line. After the cluster has been heat treated, it is located by the ground external surfaces while the bore is ground on a duplex machine.

Books Received

FUNDAMENTALS OF DIGITAL INSTRUMENTATION. By D. S. Evans, M.I.E.E. Hilger & Watts, Ltd., 98 St. Pancras Way, London, N.W.1. 39 pp. [Price 7s. 6d. net.]

Arrangements for presenting automatic digital displays of various quantities are finding increasing application on certain machine tools, batch counters, electronic computers, and other equipment, and some of the systems employed have much in common. This book is concerned mainly with shaft-driven digitisers, but it also covers decoding, cycling, sampling and storing. The advantages of the variants of the binary scale are discussed, and arrangements are described whereby backlash errors may be avoided where gears are employed. Reference is also made to systems for conversion between the binary variants, and for converting binary to decimal.

DAVID BROWN'S—THE STORY OF A FAMILY BUSINESS, 1860-1960. By Desmond Donnelly, Collins Publishers, 14 St. James's Place, London, S.W.1. 128 pp. [Price 21s. 0d. net.]

No mechanical engineer today will question the existence or importance of the David Brown organization which, however, like many similar businesses started in comparative obscurity. In this book, the author traces the origin of the firm back to 1860, when David Brown, the grandfather of the present chairman, was only 17 years old. The fortunes of the company are followed through the first world war, the years of depression, and the second war, and it is shown how engineering techniques were developed and applied by the many outstanding men who served the organization.

DIFFRACTION GRATINGS AS MEASURING SCALES. By John Guild, O.B.E., A.R.Sc., D.I.C., F.Inst.P. Oxford University Press, Amen House, London, E.C.4. 211 pp. [Price 35s. 0d. net.]

Simpler and more convenient methods of producing accurately ruled diffraction gratings have provided the engineer, physicist ,and metrologist with a new technique for precision linear and angular measurement, and the author has provided a useful and authoritative introduction to the subject. Aspects considered include the application of moiré fringes to linear measurement; fringe counting; fractional interpolation; forms and types of gratings; and the use of the moiré system for angular measurement. Appendices are devoted to photo-transistors and recent developments.

BRITISH WOODWORKING MACHINERY. The Machine Tool Trades Association, Brettenham House, Lancaster Place, London, W.C.2. 72 pp.

Printed throughout in English, German, French, and Spanish, this useful guide includes a foreword, an index to products made by members of the Woodworking Section of the M.T.T.A., an index to manufacturers, and a section devoted to manufacturer's entries. In the product index, the various machines are grouped under such headings as sawing; planing, moulding, and shaping; mortising; and single end tenoner and finger jointing. Against each type of machine, code numbers are given whereby the names of the makers can be identified in the next section, which is arranged alphabetically. In the final section, typical machines are illustrated, and notes are included on the activities of the various companies.

THE DECISIONS OF ENGINEERING DESIGN. By D. L. Marples, M.A., A.M.I.Mech.E. The Institution of Engineering Designers, 38 Portland Place, London, W.1. [Price 2s. 6d. post free.]

Following some experiments in training for engineering graduates, the Nuffield Foundation sponsored research into the problems of training engineering designers. The results of some of this research are contained in the paper, in which two examples of plant design are described and an abstract model of the process of design is suggested. In connection with this model the search for possible solutions to design problems is discussed, also the strategies for their examination, and the rules for choosing between them.

Some further research in this field may be undertaken if the comments of engineers and educationalists suggest that it is worth-while.

E.I.A. Hitchin Display

A one-day display organized by the North Hertfordshire and District Group of the Engineering Industries Association was held recently at the Hitchin Town Hall, Brand Street, Hitchin, Herts., and 41 member firms participated. The majority of exhibitors were from Hertfordshire and neighbouring areas, but several had come from districts to the South and West of London and one from Birmingham.

Prominent on the stand occupied by Benton Engineering Co., Ltd., Tonbridge Road, Harold Hill, Romford, Essex, was the prototype ⅝-in. capacity unit drilling head shown in Fig. 1. This unit, which is the subject of patent application 30885/60, operates on an automatic cycle which is started by push-button and stopped when a micro-switch is triggered at the end of the return stroke. A differential mechanism provides steplessly-variable feeds and rapid traverse motions in forward and reverse directions, the total stroke being 2 in. The spindle is belt driven by a ¾-h.p. motor at speeds up to 2,870 r.p.m. In the figure, the head is shown set up for drilling ¼-in. diameter holes in brass slugs, that are held in a fixture which is opened and closed by means of the hand-operated, rapid-action, lever clamp at the left.

A wide variety of air-operated tools and examples of compact workshop equipment were shown by Air Tools & Accessories, Ltd., Ebburns Road, Hemel Hempstead, Herts. The products on view included a Bux L-3RD magnetic drill stand, on which was mounted a Black & Decker heavy-duty portable electric drill, as seen in Fig. 2. The 6¾-in. diameter, mains-operated, magnetic base is stated to exert an attractive force of 3,000 lb. for the consumption of 60 watts, and to provide satisfactory holding power to withstand drill point forces up to 2,000 lb., as may be

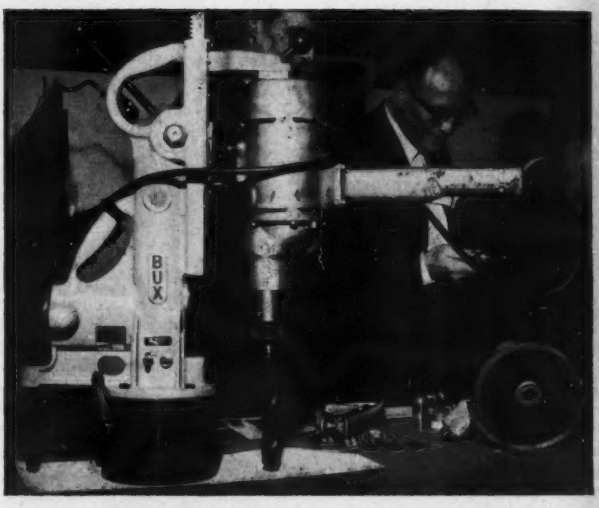


Fig. 2. Bux drill stand with magnetic base exhibited by Air Tools & Accessories, Ltd. It is here seen supporting a Black & Decker heavy-duty drill

Fig. 1. Unit drilling head, of ⅝-in. capacity, made by Benton Engineering Co., Ltd.

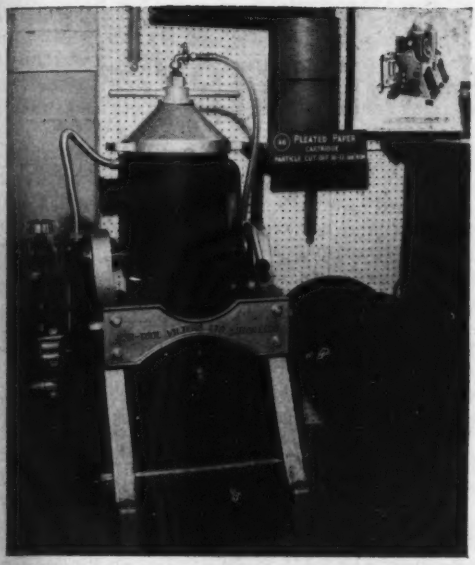


Fig. 3. Filter unit for lubricating oils and coolants, made by Par-Tool Filters, Ltd.

required for drilling holes up to 1¾ in. diameter. A cam-operated, radial swivelling device enables the drill point to be positioned accurately on the work. The attached drill or other portable power tool has a movement of 13 in. by rack and pinion.

Par-Tool Filters, Ltd., Langley Street, Luton, Beds., displayed self-contained, pressure fed, filtration units for separating solid particles from a wide variety of oils and other liquids used in industry. The standard 32-in. high Mk.2 filter, shown in Fig. 3, has disposable cartridge type elements, each with a surface area of approximately 280 sq. in., for separating entrained particles from lubricating oils, coolant for grinding machines, and honing fluids, for example. A soiled filter element can readily be withdrawn from the trunnion-mounted cylindrical container. The conical cap is removed, and the container tilted forward to a horizontal position to enable the element to be withdrawn and placed on a tray. A demonstration set-up was repeatedly operated to show the effectiveness of the equipment for removing finely divided solid particles from water.

Displays on other stands were concerned with sheet metal products, industrial brushes, soldering and brazing equipment, moulds, dies, tube benders, sectional work platforms, cams, press feeds, castings in brass and light alloys, extruded plastics, and a variety of repetition parts.

Trade Publications

James A. Jobling & Co., Ltd., Wear Glass Works, Sunderland.—The first issue of a new series of technical bulletins which are to be published every two months under the title "Pyrex Glass" includes articles on Pyrex electrically conducting coated tubes, and the use of E.C. coated tubes in nylon research.

Rank-Xerox, Ltd., 33-41 Mortimer Street, London, W.1. Four-page illustrated leaflet (R.X. 57) concerned with the company's unitized microfilm system for the reproduction of engineering drawings. The two xerographic machines for use with the system are described, namely the Copyflo 1824, and the Copyflo continuous printer, type 5B.

Vactric (Control Equipment), Ltd., Vactric House, Sloane Street, London, S.W.1. Advance information sheets issued by the company are concerned with the following products: size 11 d.c. split-field motor; size 11 d.c. tachogenerator; size 15 d.c. split-field motor; and size 10 and 18 ball bearing gear-heads.

Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14. Brochure describing the Dowding British-built single spindle sliding head automatic, which is made under licence from Bèchet, Cluses, France. The main features of the machine are described with reference to close-up views, and production times for some typical workpieces are given. There are two sizes with capacities of 10 mm. (⅜ in.) and 16 mm. (⅝ in.).

T. Norton & Co., Ltd., Carver Street, Birmingham, 1. Folder which gives illustrations and specifications of the company's extensive range of hand, foot, arbor, and air-operated presses. The hand presses, it may be noted, are available in standard, deep throat, tall, bar, double sided, gang, and extra capacity types. Powered by a 3-in. cylinder, the air operated press has a capacity of 1 ton.

Hellermann, Ltd., Crawley, Sussex. Illustrated folder describing the latest type M3 Dymo-mite hand embossing tool for producing labels from coloured plastics and metal tapes. Facilities are now provided for producing labels with rounded corners and with holes in the ends. The range of vinyl embossing tapes can now be supplied with matt finish and with edges of a colour different from that of the central strip.

Vereinigte Drehbank-Fabriken (Gebr. Boehringer G.m.b.H., Goppingen. Heidenreich & Harbeck, Hamburg, and H. Wohlenberg, K.G., Hanover).—Brochure, excellently illustrated in full colour, describing the VDF 18, 21, and 24 RO lathes with centre heights from 7 to 9½ in. Specifications and details of extra equipment available are clearly set out. Sections are then devoted to bed and main drive, headstock features, accuracy, feeds, carriage and apron, compound rests and toolposts, tailstock, and electrical equipment. A separate folder gives brief details of various machines in the VDF range including centre, copying, turning and boring, turret, crankshaft, and special-purpose lathes; deep hole boring machines; planing machines; and bevel gear generators. V.D.F. lathes and borers are handled in this country by Sykes Machine Tool Co., Ltd., The Hythe, Staines, Middx.

NEWS OF THE INDUSTRY

Lancashire

PROPULSION, The Lodge, Greenbank Mills, Greengate Street, Oldham, are occupied with the design and supply of marine propeller and stern-gear equipment for use with diesel engines in a range from 10 to 150 b.h.p. The manufacturing organization, Vertoma Jig & Tool Co., Ltd., Moorside Works, Ripponden Road, Oldham, in addition to making this equipment, are busy with the production of tools, fixtures and jigs for a variety of customers, including machine tool builders, and the aircraft, motor car, and television industries.

A contract machining service ranging from general engineering to precision work is also provided. In addition, the company undertakes the complete construction of special purpose machines and equipment to users' specifications.

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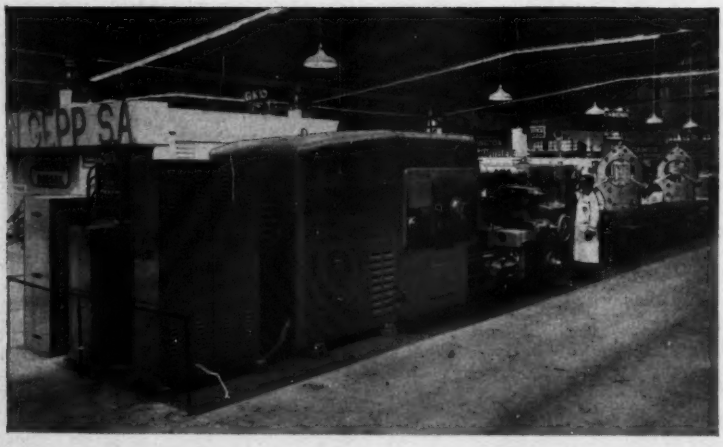
In MACHINERY, 98/296—8/2/61, reference was made to the machining of the headstock for an IMOR type TP100 heavy duty lathe at the works of Maquinas Agricolas Romi, S.A., Santa Barbara d'Oeste, Brazil. A completed lathe is here seen being demonstrated at a recent industrial exhibition in Sao Paulo. Designed for roll-turning and the machining of marine propeller shafts, the lathe will admit 32 ft. between centres, and weighs 61 tons. It is powered by a 100-h.p. motor, and will exert a maximum torque of more than 72,000 lb.-ft.



HENRY LOWE & SONS, LTD., Falcon Works, Royton, report a further increase in demand for their range of passenger and goods lifts, and overhead runways. In addition, a substantial amount of fabrication work, on a contract basis, is at present being handled. There is a steady call on the company's services as contract machinists, and it was noted that the section of the works devoted to the production of jigs, tools, and fixtures is busy on equipment for many branches of industry. Certified dead-load testing of all types of lifting equipment up to a maximum of 20 tons can be carried out.

S. CROWTHER (ROYTON), LTD., Milton Street, Royton, are makers of stern-gear equipment and propellers in a wide range of sizes and types for the marine engineering industry. The Crowther & Perkins (Four 99) unit, which was developed in conjunction with F. Perkins, Ltd., Peterborough, and W. R. Anderton & Co., Ltd., Rochdale, is a "package unit" comprising a Perkins 40 s.h.p. by 3,600 r.p.m. diesel engine, a clutch and reduction gear, and a 21-in. diameter controllable pitch propeller, with blades which can be swivelled to give forward or reverse movement. Other activities include precision contract machining work and the building of special and prototype machinery to the company's or customers' designs. We are informed that recent orders have included one for the supply of 100 creep testing machines for the National Engineering Laboratory, East Kilbride, and another, for 12 similar machines, for the British Cast Iron Research Association.

TWEEDALES & SMALLEY, LTD., Castleton, Rochdale, inform us that whereas the level of export orders is being satisfactorily maintained, there has been a definite increase in the call for their equipment from the British textile industry. New plant recently in-

stalled includes a Roto-Finish barrel finishing machine, a Herbert No. 5 automatic lathe, and a Herbert No. 9.B. turret lathe. The ferrous and non-ferrous foundries, which have been partly mechanized, are maintaining an output of approximately 90 tons of castings per week.

A recent addition to the works is a glass fibre department which is concerned with the production of guards for fitting to various machines. We are informed that this department is being steadily developed to supply the company's needs, also those of Textile Machinery Makers, Ltd.

In our last report on this firm, reference was made to the formation of two new companies for the manufacture of industrial air-conditioning and refrigeration plant, and passenger and freight lifts, and we may note that production has now begun on these new lines. Both manufacturing units are housed in a works extension with an area of some 30,000 sq. ft., and new machines and equipment installed include a British Oxygen Bison profile cutting machine, a Cardiff C. No. 1 combined punching and shearing machine, a Rhodes 8-ft. by ¼-in. capacity guillotine shearing machine, a Smith (Keighley) 5-ton capacity crane, and an Aerograph De Vilbiss water wash paint spray booth and stoving plant.

R. SUTCLIFFE.

London and the South

MIDDLESEX TOOL & GAUGE CO., LTD., Park Royal Road, N.W.10, are fully occupied with the design and production of a wide variety of fixtures, gauges, press tools, moulds, and special-purpose equipment.

The existing 23,000 sq. ft. of productive floor space, which is fully utilized, is shortly to be increased by a further 12,000 sq. ft., and this extension will be reserved for the production of unit heads and supplementary equipment. Among the new machine tools recently installed in the main shop is a Webster & Bennett vertical boring and turning mill which has a capacity for work up to 84 in. diameter.

WM. HURLOCK, JNR., LTD., 5 Kingston Hill, Kingston-on-Thames, Surrey, are experiencing a sustained demand for engineers' small tools, machine tools, and workshop equipment. This company maintains large stocks of grinding wheels, reamers of different types, and a wide range of twist drills, for the convenience of users in the locality and in distant areas. Additional stocks of slotted angle constructional material have recently been acquired.

J. P. SANDERS & CO. (TRUTOOLS), LTD., Campbell Road, Croydon, Surrey, who are specialists in the production of follow-on press tools for makers of watch, clock, and instruments parts, are still very busy. Another activity for which this firm is noted is the production of flat and circular form tools, many examples of which are in progress now.

Three Wickman optical profile grinders are installed, in addition to other grinding machines suitable for accurate work, and delivery is awaited of a GKN Mk.2 B spark erosion machine, which is to be employed for piercing and shaping tungsten carbide die parts. The Parometer 12-in. height comparator, which is fitted with a tilting head and is available in two versions, designated class A and B, with stated accuracies of 0·0001 and 0·0003 in. over the range of adjustment, is becoming more widely used in this country, and is now to be sold in export markets.

BOURDON TOOLS, LTD., Union Road, Croydon, Surrey, are building the PM.2 vertical spindle surface grinding machine for sale in the United Kingdom and overseas. A section of the works is concerned with the construction of special purpose equipment, prototype machines and fixtures, also with the accurate machining of components.

REALM ENGINEERING WORKS, LTD., Milton Avenue, Croydon, Surrey, report a growing demand for plug cocks, valves, and other pipe fittings made from stainless steel, with bore diameters up to 4 in., for food and dairy product processing plants. Occasionally, stainless steel parts are also produced here for other applications. The Royal 10-in. stroke shaping machine is in steady request, and several are on order for export.

CROYDON TOOL & CASEHARDENING SPECIALISTS, LTD., Union Road, Croydon, Surrey, are as busy as ever. Workpieces which are to be subjected to various forms of heat treatment are handled either singly or in batches, in departments which are equipped with salt bath and other types of furnaces. We may note that a Lucas gas-fired circulating atmosphere furnace has recently been installed, for the treatment of light alloy parts.

F. W. HERRIDGE.

London Association of Engineers

The dinner to mark the 109th anniversary of the foundation of the London Association of Engineers was held at the Criterion Restaurant, Piccadilly, London, W.1, on March 17, and was attended by some 160 members and guests. The principal speaker was Lt.-Col. A. Marriot, T.D., F.B.I.M., M.I.Prod.E., who proposed the toast to the

engineering industry and the Association, to which Mr. F. V. Smith, president of the Association, responded. Mr. L. Harding, vice-president of the Association, proposed the toast to the guests, and Mr. F. E. McGinnety, C.B.E., M.Sc., M.I.E.E., replied.

As at previous dinners, prizes were presented to apprentices who were successful in the annual competition organized by the Association. Entrants are required to submit a piece of equipment that they have made, full working drawings and a thesis, and the entries this year maintained the very high standard that has come to be expected in this competition. The Junior Challenge Shield and first award were presented to Mr. B. J. Tidmarsh (C.A.V., Ltd.), second prizes jointly to Mr. R. D. Munro (Pheonix Telephone and Electric Works, Ltd.) and Mr. G. Jones (Rheostatic Co., Ltd.), and the third prize to Mr. H. B. Taylor (C.A.V., Ltd.).

Use of Models in Design

(*Continued from page* 695)

lish the required correlation of behaviour as regards both deflection and vibration.

With these data available, other models of proposed new machines can be prepared and tested before designs are finalized, and if necessary modifications can be made rapidly, and, relatively, very inexpensively, to ensure that the full size machine will perform as intended. The first of these models, we understand, was made in connection with the development of a planing machine, and the work was found to be fully justified in view of the significant improvements that were achieved in consequence. Essentially practical research work of this nature, to which growing importance is rightly being attached, will undoubtedly play a vital part in facilitating future advances in machine tool design.

New Protolite Film

The second edition of the film entitled "Hard Metal," the original version of which was produced some 11 years ago, was recently shown in London by Protolite, Ltd., Rainham, Essex. Made at the works of the parent company Murex, Ltd., of the same address, the film shows in detail the manufacturing processes for tungsten carbide tools, starting with the treatment of wolfram and scheelite ores.

The opening sequences indicate the wide field of application for tungsten carbide in modern tooling. Next, the progress of the ore concentrates through successive chemical treatments is followed. Each phase of the processes is explained with the aid of diagrams. Finally, the equipment which is used to produce the cutting tools is shown; also views of tungsten carbide tooling set-ups at various works.

This colour film runs for 50 min. and copies will be available, free on loan, in a few months' time.

B.A.M.T.M. Dinner and Dance

The annual dinner and dance, held at the Trocadero, London, W.1, on March 17, was the tenth of the series organized by the British Association of Machine Tool Merchants which is this year celebrating the 21st anniversary of its foundation. As on former occasions, the event was well attended by members and guests. Mr. W. E. Norton, president of the Association, proposed the toast of "The Guests," to which Mr. J. C. Snow, president-elect of the Machine Tool Trades Association, replied. The toast of "The Ladies" was then proposed by Mr. C. G. Newbury, a member of the Council, and Mrs. C. H. Payne responded.

George Bray Memorial Lecture

The 1960 George Bray Memorial Lecture will be delivered by Mr. H. Silman, B.Sc., F.R.I.C., M.I.Chem.E., F.I.M., a past-president of the Institute of Metal Finishing and a director of Electro-Chemical Engineering Co., Ltd. Mr. Silman's subject will be "The Protective Treatment of Metals Against Corrosion," and the lecture will be given in the Pillar Hall, Olympia, on April 26 at 4.15 p.m., which will be the day of the official visit of the Institution of Production Engineers to the Engineering, Marine, Welding and Nuclear Energy Exhibition. Tickets for members of the Institution and their friends, which will also admit holders to the Exhibition, can be obtained from The Secretary, The Institution of Production Engineers, 10 Chesterfield Street, Mayfair, London, W.1. Early application is advisable.

New Appointments

The following new appointments have been announced:—

MR. LESTER GILL, as manager, Scottish Division, and MR. W. A. SHAW, as manager, North Midland Division, for Power Petroleum Co., Ltd., 76-86 Strand, London, W.C.2.

MR. J. LEWIN, A.M.I.C.E., A.M.I.Mech.E., as materials handling engineer for BTR Industries, Ltd., Herga House, Vincent Square, London, S.W.1. He will be responsible for the development of mechanical handling techniques within the BTR group.

MR. H. REES as technical representative for Headland Gauges, Ltd., 45-46 Lower Marsh, London, S.E.1, for Berks., Bucks., Beds., Essex, Suffolk, Norfolk, Northants, Herts., and North London postal districts; and MR. J. S. MITCHELL as technical representative for Kent, Surrey, Sussex, Middlesex and South London postal districts.

Correction

In the advertisement for Rubert & Co., Ltd., Demmings Road, Councillor Lane, Cheadle, Cheshire, which appears on p. 114 of this issue of MACHINERY, the prices given for the different sizes of clamping tools are incorrect. They should be as follows: 59/1, 54s.; 59/2, 58s. 6d.; 60/1, 70s.; 60/2, 76s. 6d.; 61/1, 102s. 6d.; and 61/2, 110s.

Industrial Notes

TAYLOR, TAYLOR & HOBSON, Stoughton Street, Leicester, a division of Rank Precision Industries, Ltd., report that 1960 was a record year for the company. During the period the percentage of export sales increased from 37 to 42.

STEEL AND PIG IRON PRODUCTION.—The production of steel in February averaged 485,300 tons per week, as compared with 478,400 tons in January, and 482,200 tons in February, 1960. For pig iron the corresponding figures were, 302,400 tons, 308,500 tons, and 301,500 tons.

ADREMA (HOLDINGS) LTD., Telford Way, London, W.3, have concluded an agreement with Siemens & Halske A.-G., Munich, whereby they will market the Productograph. These units will be assembled in the United Kingdom into systems designed to meet customers' requirements.

F. PRATT & CO., LTD., Halifax, have concluded a licence agreement with Praga Tools Corporation, Ltd., Hyderabad —an Indian Government company—for the manufacture of Pratt self-centring and independent lathe chucks, over a size range from 4 to 48 in.

NEWMAN INDUSTRIES, LTD., Yate, Bristol, inform us that an order has been placed with their American company for all the electric motors—numbering several hundred—for a new chemical plant which is being built for the Whitco Chemical Co. of New Jersey, U.S.A. Deliveries will be made from stocks already held in the United States.

SALES OF PLASTICS MATERIAL in 1960 totalled 561,700 tons or 12 per cent more than in 1959. In the first quarter sales reached the record level of 147,000 tons, but this rate was not maintained over the remainder of the year. Production in 1960 was 19 per cent higher than in 1959, and stocks at the end of the year amounted to 102,900 tons.

THE GAUGE AND TOOL MAKERS' ASSOCIATION, Standbrook House, 2-5 Old Bond Street, London, W.1, will hold their next Trade Luncheon on April 20, at the Savoy Hotel, London. The Guest of Honour will be Sir Roger Makins, G.C.B., G.C.M.G., chairman of the United Kingdom Atomic Energy Authority, and he will speak about the work of the Authority.

PRESS & SHEAR MACHINERY CO., LTD., 172-178 Victoria Road, Acton, London, W.3, have been appointed sole distributors and licensees for the range of up-stroking hydraulic press brakes built in France by Promecam S.A. The company has a demonstration vehicle which is available to visit the works of any firm to show the press brake in operation.

JAMES NEILL & CO. (SHEFFIELD), LTD., Sheffield, 11, will show a wide range of their products at the British Trade Fair in Moscow, including Eclipse permanent magnet chucks of various types, permanent electro-magnetic chucks, also magnetic floaters, holders, clamps and links for welding and assembly operations, V-blocks, and bases for dial gauges.

THE UNITED STEEL COMPANIES, LTD., The Mount, Broomhill, Sheffield, 10, have issued an informative and well illustrated report for employees entitled "Review of Progress, 1960." Notes are included on the commercial situation and the activities of the various constituent companies. Other sections are devoted, to production, profit and loss account, "people," and publications.

SWISS ACHIEVEMENTS—20 YEARS WITHOUT STRIKES is the title of a lecture that will be given by Dr. Gasser, chairman of the board and president of Mikron S.A. Bienne, Switzerland, at the international conference of The Institution of Works Managers, 196 Shaftesbury Avenue, London, W.C.2, which is to be held at Bournemouth in April.

E.C.S. (COVENTRY), LTD., Much Park Street, Coventry, inform us that they are now able to supply inexpensive static balancing rigs based on the design of a successful road vehicle wheel balancer. It is stated that the units are robust, simple, and quick to use, and that they can readily be adapted to suit different components. If required, moreover, they can be arranged for incorporation in production and inspection lines.

C. A. PARSONS & CO., LTD., Heaton Works, Newcastle upon Tyne, have received an order from the Central Electricity Generating Board for four 500 MW. single-line turbo generators. The value of the order which also covers the associated feed-heating plant and turbo-driven boiler feed pumps is about £13 million. It is stated that these four machines will together increase by more than 6 per cent the total capacity of generating plant at present installed in the United Kingdom.

PEARSON PANKE, LTD., 1-3 Hale Grove Gardens, Mill Hill, London, N.W.7, inform us that, as agents for S.M.G., they supplied the Schuler-S.M.G. (now known as S.M.G.) hydraulic presses for the four lines that have been installed at the factory of Hoover (Washing Machines), Ltd., Merthyr Tydfil, for the production of outer and inner tubs for Keymatic machines. Reference to the new production facilities for these machines was made in MACHINERY, 98/562—8/3/61.

STAVELEY INDUSTRIES, LTD., is the new title which has been adopted by the organization formerly known as The Staveley Coal & Iron Co., Ltd. The companies in the group operate in three broad fields, namely, general engineering and foundries; machine tools; and salt, lime, and allied products. The machine tool companies are Cyril Adams & Co., Ltd.; James Archdale & Co., Ltd.; Cunliffe & Croom, Ltd.; George Richards & Co., Ltd.; and J. H. Shand, Ltd.

STANDARD FOR RAILWAY WHEEL TYRES.—The British Standards Institution, 2 Park Street, London, W.1, have issued B.S. 3117, wheel pairs for locomotives and rolling stock (dimensions): Part 3: tyres. It is stated that special care has been taken in its preparation to ensure that the requirements of both overseas and British Railways are covered. Copies may be obtained from the Sales Branch at the above address (price 4s. 6d.—postage extra to non-subscribers).

CLIFFORD COVERING CO., LTD., a subsidiary of Clifford Motor Components, Ltd., have recently started production in a new factory at Hall Green, Birmingham. This company specializes in the production of motor car steering wheels, and the new works will augment the capacity available at the main factory in Wharfdale Road, Birmingham, 11. Improved production methods have been introduced, and the plant installed includes three Lancastrian 400/50-ton semi-automatic transfer and compression hydraulic moulding presses supplied by Foster, Yates & Thom, Ltd.

EXPANSION OF BOARD OF TRADE ACTIVITIES AT OVERSEAS TRADE FAIRS.—A proposal will shortly be laid before Parliament seeking approval to increase next year's vote provision for trade fairs, trade weeks, and similar activities overseas, by some £200,000 to a total of £530,000. The extra money will be used to encourage, in co-operation with trade associations, more firms to take part in overseas trade fairs, particularly specialized fairs; to improve the adequacy of British representation in major international trade events; and to give more support to " British Weeks " and other special promotions overseas.

MELBRO MACHINE TOOLS, LTD., Melbro House, 2a Alexandra Road, Manchester, 15, inform us that they have recently received substantial orders from six foreign shipyards for equipment which includes magnetic trolleys, magnets for ship plate welding, lifting beams, and magnetic drill posts. The magnetic trolley, it is pointed out, can be wheeled to the work by one man, who then switches on the magnets and operates a hydraulic jack to align plates, for example, or press a stringer down into position. Magnets for plate welding are available with cohesive forces from 6,615 to 2,240 lb.

JONES & ATTWOOD, LTD., Stourbridge, Worcestershire.—As a result of ill health, Mr. W. Stringer-Jones, D.F.C., has resigned from the positions of chairman and managing director, and the business has been acquired by The Mining Engineering Co., Ltd., Worcester. Mr. Bernard Higgins, joint managing director of the latter company, is now, in addition, chairman and managing director of Jones & Attwood. Mr. G. W. Stanbury, Mr. W. E. Hand, and Mr. P. N. Hood remain on the board. The company will continue to make and market sewage purification machinery, pipes, power presses, heating installations, and other products.

WELDING IMPROVEMENTS, LTD., P.O. Box 32, Lady's Lane, Northampton, are marketing, under the trade name Fontargen, a comprehensive range of low heat input metal joining alloys. This range comprises numerous types of coated arc welding electrodes; also rods and fluxes for use with oxy-acetylene, gas-air, induction, resistance, furnace, and other heating methods. There are groups for application to cast iron and steels, including stainless qualities; copper, brass and bronze; light alloys; and nickel alloys. Other products include a selection of silver brazing alloys, various special soft solders; surfacing alloys for heat-, wear-, and corrosion-resistance; and electrodes for cutting and gouging.

TRADE WITH EAST GERMANY.—Negotiations between the Federation of British Industries and the Chamber of Foreign Trade of the German Democratic Republic have resulted in a bilateral agreement for 1961 which provides for a total trade (import and export) between the countries of £18 million. In 1960 the agreed total was £14 million and the actual total £13·3 million (British imports £6·3 million and British exports £7 million).

There is provision for British exports this year of iron, steel and non-ferrous metals to the value of £3·5 million, machine tools (£220,000), and chemical plant (£200,000). For machine tool imports from the G.D.R. the agreed figure is £295,000.

THE PURCHASING OFFICERS ASSOCIATION, Wardrobe Court, 146A Queen Victoria Street, London, E.C.4, will hold the 1961 Minibition at the Hotel Metropole, Brighton, from September 28 to 30, in conjunction with the annual conference. Prospective exhibitors can obtain full particulars from the secretary, at the above address.

REYNOLDS & WILSON, LTD., the London representatives of Abwood Machine Tools, Ltd., Denham's Engineering Co., Ltd., John Pickles & Son (Engineers), Ltd., Scottish Machine Tool Corporation, Ltd., and Fredk. Town & Sons, Ltd., inform us that their address is now Lion House, Red Lion Street, Richmond, Surrey.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs., will in future employ Stelvetite extensively for facing cubicles for industrial electronic control equipment. This plastics-coated steel sheeting is supplied by John Summers & Sons, Ltd., Shotton, Chester, and it is stated that its adoption instead of stove-painted panelling will enable both production time and costs to be reduced. An incidental advantage will be the elimination of individual instruction panels. The instructions will be imprinted directly on the plastics facing by the Masseeley process.

F. J. STOKES, LTD., is the title of a subsidiary company which has been formed by F. J. Stokes Corporation, Philadelphia, U.S.A. This new company, which has offices at 115 High Holborn, London, W.C.1, will build some of the machines and equipment from the Stokes range, for the plastics, chemical, pharmaceutical, electronics, and food industries, for sale in the British Isles, the Commonwealth, and the E.F.T.A. countries. It is stated that British production of Stokes equipment is already being undertaken in association with Thomas White & Sons, Ltd., Paisley. Products of the Stokes organization include plastics moulding presses, metal powder presses, vacuum metallizing equipment, and vacuum heat treating and melting furnaces.

AT THE BRITISH TRADE FAIR IN MOSCOW, four members companies of the Turner & Newall, Ltd., organization will participate with a joint stand, as follows: Turner Brothers Asbestos Co., Ltd., Rochdale (a wide range of asbestos textile products, jointings, conveyor, elevator, and power transmission beltings, and plastics reinforcement materials); J. W. Roberts, Ltd., Bolton (Ferobestos asbestos-reinforced plastics, and sprayed Limpet asbestos insulation); Washington Chemical Co., Ltd., Washington, Co. Durham (magnesium compounds for industrial and pharmaceutical uses); and Ferodo, Ltd., Chapel-en-le-Frith (brake and clutch linings for a great diversity of applications, fan and driving belts, friction stair treads, and other products).

Creative Engineering Seminar

Industrial Education International, Ltd., 66 Chandos Place, London, W.C.2, have made arrangements for 2-day seminars with the theme "How to Develop Creative Engineering" to be held in Manchester on May 1 and 2, in London on May 4 and 5, and in Birmingham on May 8 and 9. In this connection, the view is expressed that: "most engineers utilize only part of their creative ability—much of their thinking is confined to the narrow framework of their own experience or standard practices . . ." The seminars will be conducted by Mr. A. L. Simburg, supervisor, Personnel Research and Development, AC Spark Plug Division, General Motors Corporation, and their purpose will be to increase "the engineer's effectiveness to his company and himself." Creative Engineering will be defined and methods of overcoming obstacles to creativity will be discussed, also approaches to creative thinking, and supervising for creativity.

Full particulars and registration forms can be obtained from the above address.

Scrap Metals

†London.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £195; clean heavy copper, untinned and free from lead and solder, £190; copper wire No. 2, £184; clean light copper, £180; braziery copper, £168; gunmetal, £175; brass, mixed, £124; lead, net, £54; zinc, £45; cast aluminium, £105; old rolled aluminium, £110; battery lead, £27; unsweated brass radiators, £100; hollow pewter, £535; black pewter, £410.

Midlands.—The market tone as regards copper has shown no improvement, mainly because there is no shortage of this metal, but also on account of a slight easing of tension in the Congo. In marked contrast, there has been much activity in tin, on account of anxiety over supplies, and so far the price has increased by £17 per ton with the possibility of further rises in the near future.

Copper.—Most grades are in demand, but rather less interest is shown in No. 2 wire and braziery. Prices generally have fallen by about £2 per ton.

Brass.—Mixed grade is still favoured as against rod scrap which does not command a higher price.

Gunmetal.—Demand is good, and slightly higher prices should be obtained due to the increase in the value of tin.

Lead.—From £2 to £3 per ton more has been offered by users, on account of the recent market increases, which are attributable mainly to the possibility of reduction of output by producers.

Aluminium.—The recent interest has been maintained and prices have been fairly steady. Hopes of a better tone in the future have thus been strengthened.

Zinc.—Market fluctuations have resulted in very little change in values, and demand is steady.

White Metals.—Assuming that the improvement in tin continues, pewter and solder material should be in demand and prices should rise.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
‡ Subject to market fluctuations.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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29/3/61

MANUSCRIPTS FOR BOOKS covering all branches of engineering production will receive careful consideration and should be sent to the Manager, Book Dept., MACHINERY, National House, 21 West Street, Brighton, 1.

CONDITIONS OF SALE AND SUPPLY.—MACHINERY is sold subject to the following conditions

That it shall not, without the written consent of the publishers first given, be lent, resold, hired out or otherwise disposed of by way of trade except at the full retail price of 1s. 3d. and, that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of trade; or affixed to or as part of any publication or advertising literary or pictorial matter whatsoever.

Machine Tool Share Market

Apart from gold-mining and other African shares which were depressed following South Africa's withdrawal from the Commonwealth, active and generally firm conditions prevailed in stock markets during the period covered by this report.

Interest was centred mainly in commercial and industrial ordinary shares which gained strength as a result of well spread investment demand with a market frequently short of stock. While there was some irregularity in price movements, changes on balance were mainly to higher levels, and many strong features were in evidence.

British funds and similar gilt-edged stocks held quietly steady for the most part, but final prices were below the best.

Among machine tool issues, Edgar Allen advanced 6d. to 42s. 6d.; Birmingham Small Arms, 9d. to 33s. 3d.; British Oxygen, 1s. to 31s.; Clarkson (Engineers), 1s. 3d. to 30s.; B. Elliott, 3d. to 3s. 4½d.; John Harper, 6d. to 8s. 6d.; A. A. Jones & Shipman, 8s. 1½d. to 47s. 6d.; Kerry's (Gt. Britain), 9d. to 11s. 3d.; Martin Bros. (Machinery), 6d. to 2s. 6d.; Newall Engineering, 3d. to 8s. 9d.; W. E. Norton (Holdings), 6d. to 5s.; Samuel Osborn, 6d. to 50s. 9d.; F. Pratt, 3d. to 16s. 9d.; John Shaw & Sons (Wolverhampton), 1½d. to 17s. 9d.; Sheffield Twist Drill, 6d. to 19s.; and Thos. W. Ward, 1s. 3d. to 75s. On the other hand, Arnott & Harrison lost 3d. at 14s.; Asquith Machine Tool, 2s. 6d. at 11s. 3d.; Brooke Tool, 1½d. at 7s. 3d.; Butler Machine Tool, 7½d. at 16s. 10½d.; Chas. Churchill, 3d. at 9s. 7½d.; Coventry Gauge & Tool, 4½d. at 28s. 10½d.; Expert Tool, 1½d. at 2s. 7½d.; Greenwood & Batley, 9d. at 24s. 6d.; John Holroyd "B," 9d. at 15s. 6d.; Scottish Machine Tool, 6d. at 10s.; and Tap & Die Corporation, 3d. at 15s.

A. A. JONES & SHIPMAN, LTD.—Second interim dividend of 27½ per cent.

Coming Events

INSTITUTION OF PLANT ENGINEERS. *Southern Branch.* April 5, at 7.30 p.m., at the Grand Hotel, Bournemouth; lecture on "Radio Active Isotopes in Industry."

INSTITUTION OF PRODUCTION ENGINEERS. *London-Brighton Group.* April 5, at 7 p.m., at the Old Ship Hotel, Kings Road, Brighton; lecture on "Rockets and Rocket Propulsion," by L. S. Snell.

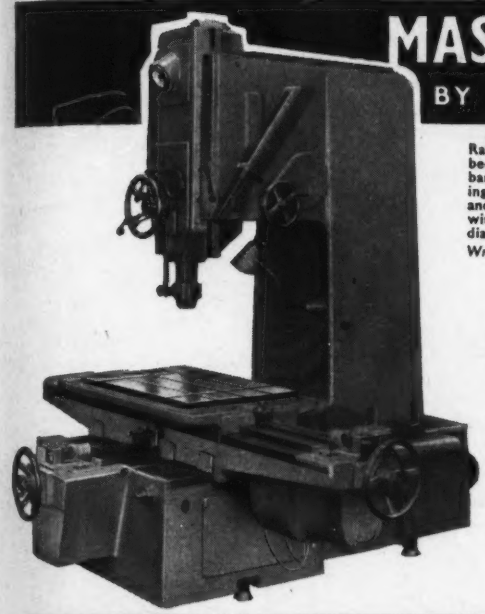
INSTITUTION OF MECHANICAL ENGINEERS. *East Midlands Branch. Graduate Section.* April 5, at 7.15 p.m., at the College of Technology and Commerce, Leicester; discussion on "The Future of the Machine Tool Industry."

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	42/6
" " "	5% Prf.	£1	14/-*
Arnett & Harrison, Ltd.	Ord.	4/-	14/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	11/3
" " "	6% Cum. Prf.	£1	16/3
Birmingham Small Arms Co., Ltd.	Ord.	10/-	33/3
" " "	5% Cum. "A" Prf.	£1	14/6
" "	6% Cum. "B" Prf.	£1	16/6
" " "	4% 1st Mort. Deb.	Stk.	90½
British Oxygen Co., Ltd.	Ord.	5/-	31/-
" " "	6% Cum. Prf.	£1	20/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	7/3
Broom & Wade, Ltd.	Ord.	5/-	26/9
" "	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	16/10½
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	9/7½
" " "	6% Cum. Prf.	£1	25/9‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	30/-xd
Cohen (George), 600 Group, Ltd.	Ord.	5/-	13/6
" " "	4½% Cum. Prf.	£1	13/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	28/10½
"	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	11/1½
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/4½
" "	4½% Red. Cum. Prf.	£1	12/-
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/7½
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/-
Greenwood & Batley, Ltd.	Ord.	10/-	24/6
Harper (John) & Co., Ltd.	Ord.	5/-	8/6
" "	4½% Red. Cum. Prf.	£1	12/1½
Herbert (Alfred), Ltd.	Ord.	£1	67/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	16/3
" " "	"B" Ord.	5/-	15/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	47/6xd
" " "	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	22/6
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	11/3
Macreadys Metal Co., Ltd.	Ord.	5/-	16/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	11/6
Newall Engineering Co., Ltd.	Ord.	2/-	8/9
Newman Industries, Ltd.	Ord.	2/-	5/6
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/6
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	5/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	50/9
" " "	5½% Cum. Prf.	£1	24/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	16/9
Sanderson Kayser, Ltd.	Ord.	10/-	37/6
" " "	6½% Cum. Prf.	£1	18/-
Scottish Machine Tool Corporation Ltd.	Ord.	4/-	10/-
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	50/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	17/9
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/-
" " "	5% Cum. Prf.	£1	14/3
Stedall & Co., Ltd.	Ord.	5/-	8/9
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	26/3
Tap & Die Corporation, Ltd.	Ord.	5/-	15/-
" " "	4½% Deb. 1961-1977	Stk.	82½
Wadkin, Ltd.	Ord.	10/-	20/-
Ward (Thos. W.), Ltd.	Ord.	£1	75/-xd
	5% Cum. 1st Pref.	£1	14/-
	5% Cum. 2nd Pref.	£1	22/-
Willson Lathes, Ltd.	Ord.	1/-	3/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

MASTER BAR Jig Borer

BY BUSWELL & SWEENEY

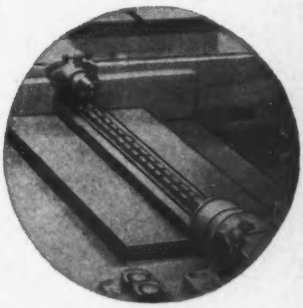


Rapid, super-accurate setting facilitated by new Master Bar system. Accurate because it returns to first principles in the use of gauge blocks and large barrel micrometer: rapid because this time-proven method incorporates an ingenious electro-mechanical system which eliminates the handling of blocks and provides automatic power cut-out and table braking when the table is within 0·01 in. to 0·02in. of the required position. Final adjustment is by large diameter handwheel and dial indicator.

Write for full details.

BRIEF SPECIFICATION

Table size: 25in. by 42in.
Longitudinal travel: 30in.
Saddle cross movement: 18in.
Settings to 0·0002in.
Steplessly variable spindle speeds up to 1,800 r.p.m.
Feeds (4) from 0·001in. to 0·008in.
Power setting traverse 60in. per min.
Floor space: 115in. by 115in.



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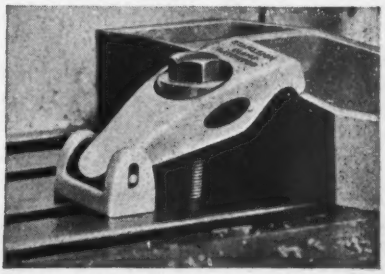
J & S-STANLEIGH

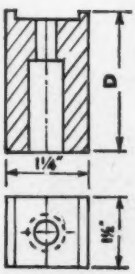
machine clamps...



SIZES AND CAPACITIES

Size No....	4	6	8
Length of clamps... ...	4in.	6in.	8in.
Width of clamp	1½in.	2½in.	2½in.
Ball washer for bolt size	⅜in. or ½in.	⅜in. or ½in.	⅜in. or ½in.
Capacity (height adjustment) without packing block	2in.	2½in.	3in.

J & S—Stanleigh Universal Clamps are a practical and economical aid to increased production. They are manufactured in three standard sizes to give 2in., 2½in. and 3in. height adjustments. The clamps are fully universal, making a perfect clamping contact at any height from zero to the maximum capacity and allow up to 15 degrees tilt all the way up by simply tightening a nut, which does not distort the bolt.



PACKING BLOCKS

PACKING BLOCKS

Three standard sizes of screw-on-packing blocks are manufactured to enable the height adjustment of the clamp to be increased
Size (D): 1in., 2in. and 3in.

Stocked by all J & S small tool distributing agents.

J & S -small tools

A. A. JONES & SHIPMAN LTD., LEICESTER.
Tel. 823222. Telegrams: "Chuck" Leicester.

When answering advertisements kindly mention MACHINERY.

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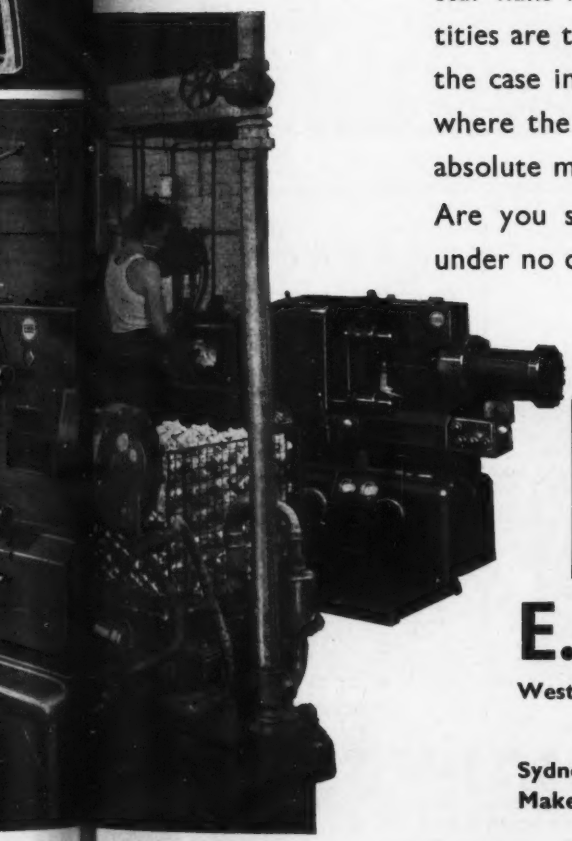
Tie up the loose ends

with an E.M.B. diecaster!—and there are a lot of 'loose ends' in engineering production which would benefit.

Parts with awkward machining problems like carburettor bodies or those items like star nails for woodwork, where large quantities are the main consideration—or to take the case in point—Vulcan sewing machines, where the parts must go together with the absolute minimum of machining.

Are you sure we can't help *you*? You're under no obligation by making sure!



Capacities:

Machine ...	6	10	12A	16	20A
Zinc lb. ...	¼	2¼	6·3	13·6	25·7
Alum lb. ...	—	1¼	2·1	4·5	—
Max. die ...	8½ × 9½	16 × 10	20 × 12½	28½ × 16½	35½ × 19¾
Platen stroke	4½	6	8	11	13

E.M.B. Co. Ltd.

West Bromwich ——————— England

With acknowledgement to

Sydney S. Bird & Sons Ltd. of Poole, Dorset
Makers of Vulcan Miniature Sewing Machines

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PRESSURE AND GRAVITY DIECASTINGS IN ALUMINIUM AND ZINC BASE ALLOYS SAND CASTINGS AND SHELL MOULDED CASTINGS IN ALUMINIUM, GUN-METAL, BRASS, ETC.

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CROWN

SURFACE TABLES

GRADE 'A'

Hand scraped and surfaced to within 0·0001in. to 0·0003in. from a mean true plane over whole surface according to size.

GRADE 'B'

Smooth planed finish accurate 0·001in to 0·003in. according to size.

Sizes up to 4ft. by 2ft. have three-point support.

Sizes 4ft. by 3ft. to 6ft. by 4ft. have five-point adjustable support.

Sizes 8ft. by 3ft. to 12ft. by 6ft. have six-point adjustable support.

Our Grade 'A' tables conform to B.S.S. 817-1938 in all respects.

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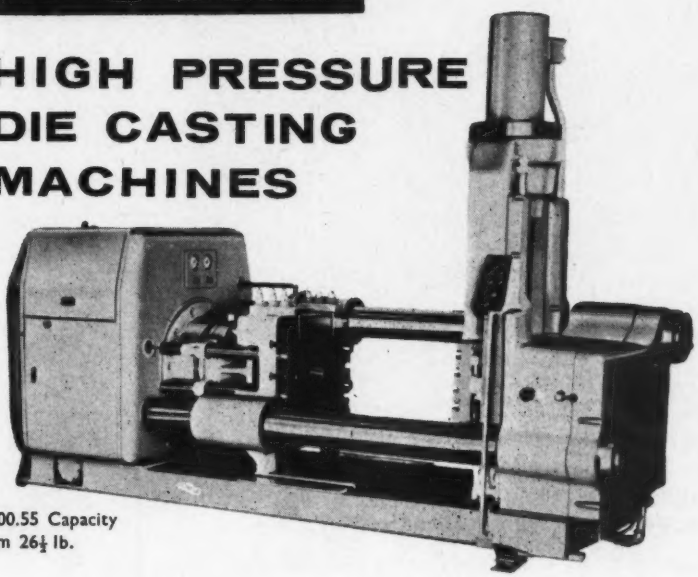

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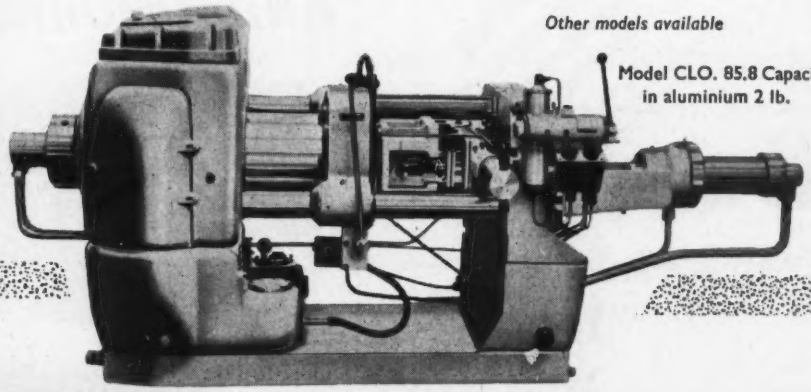

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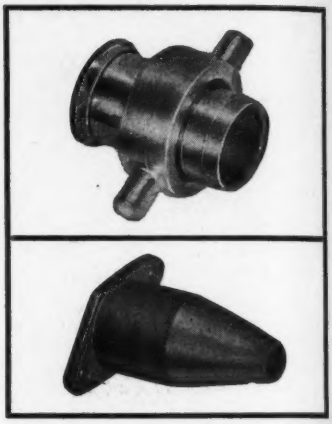

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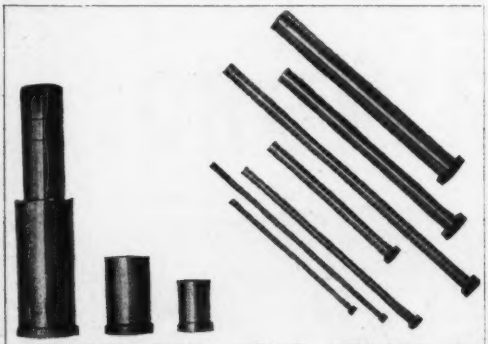

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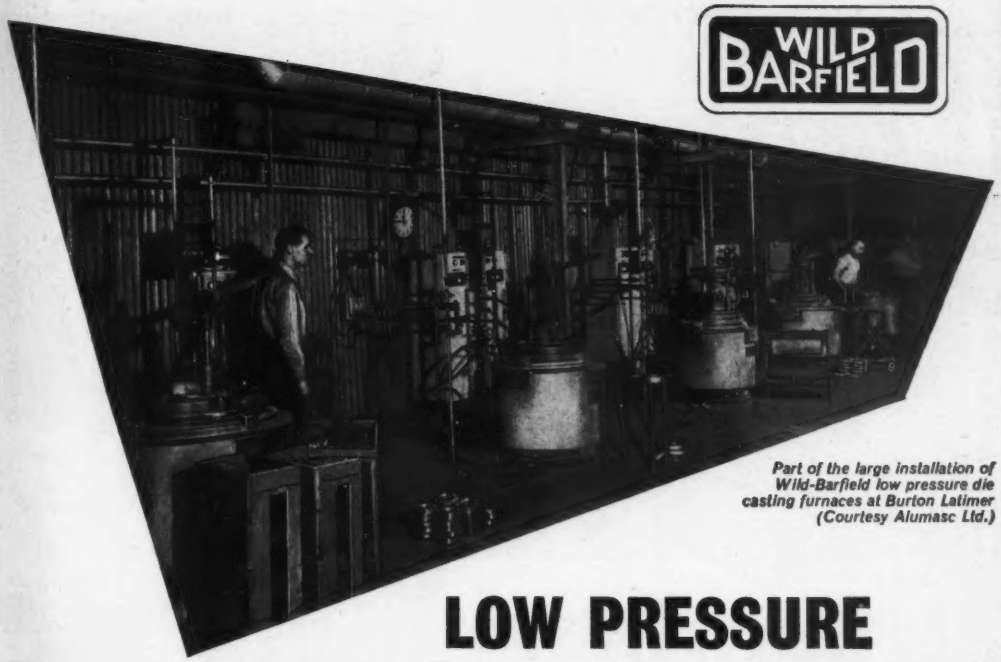

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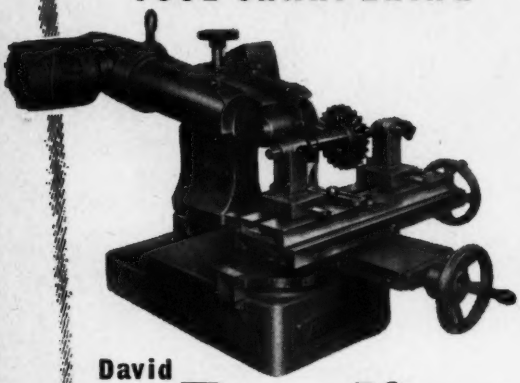

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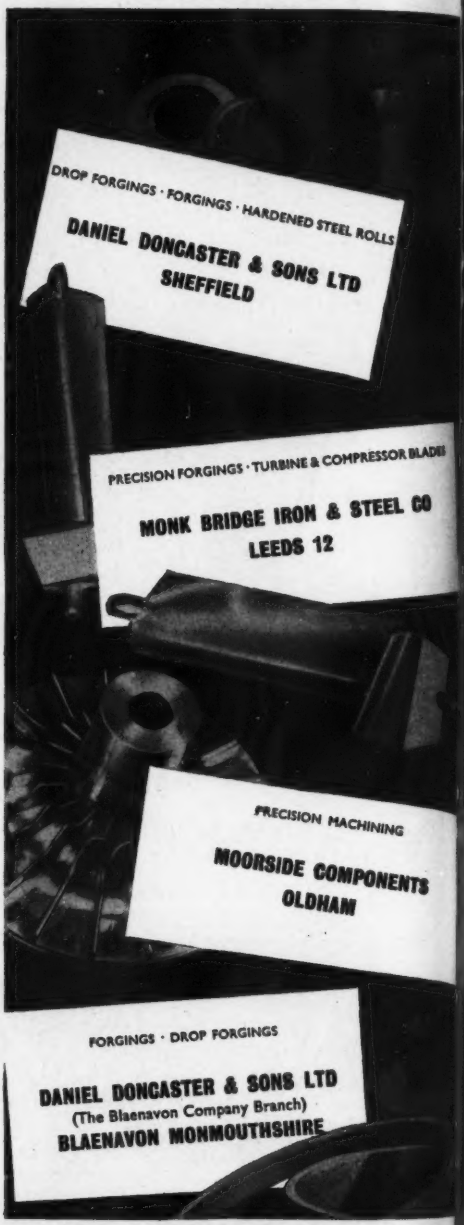

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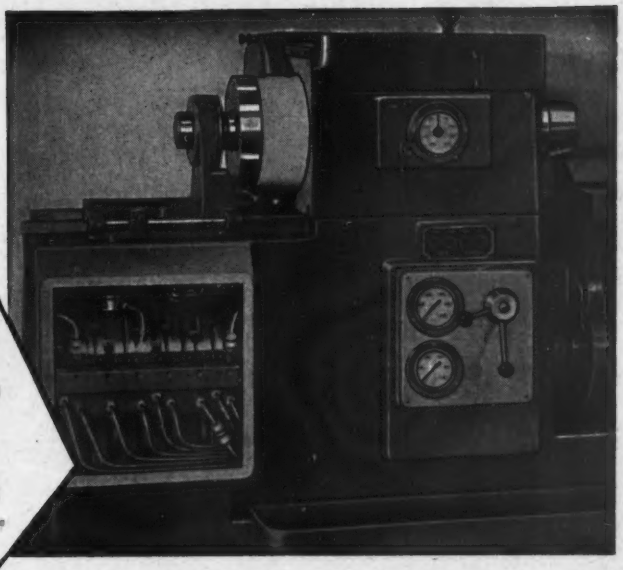

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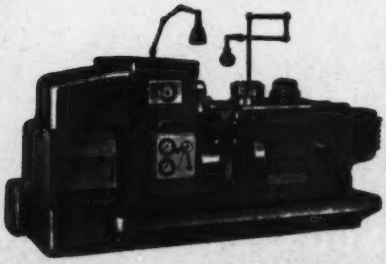

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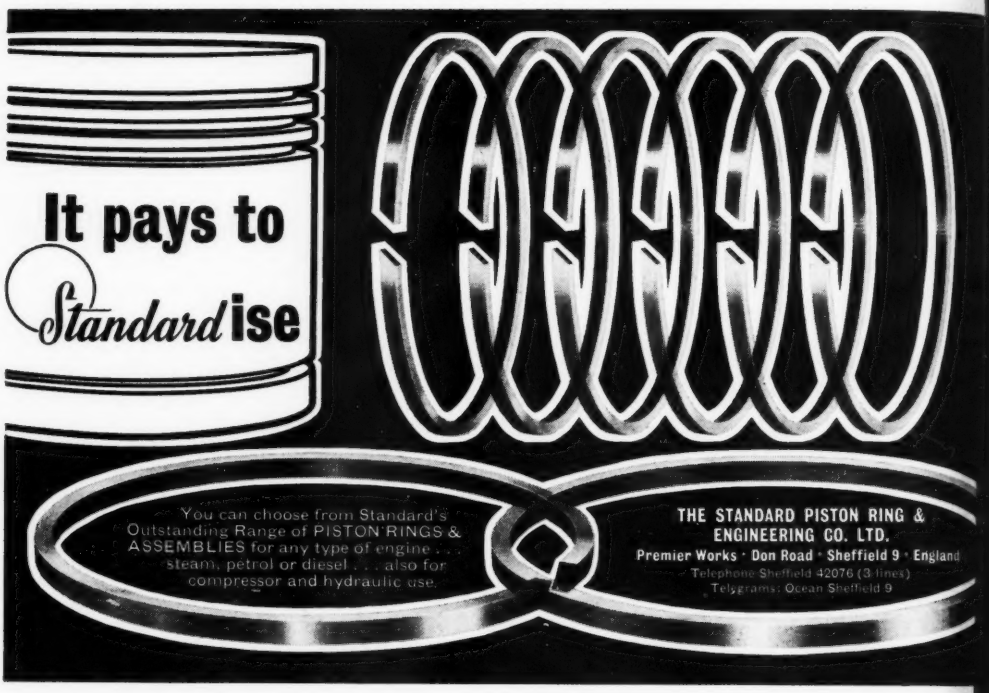
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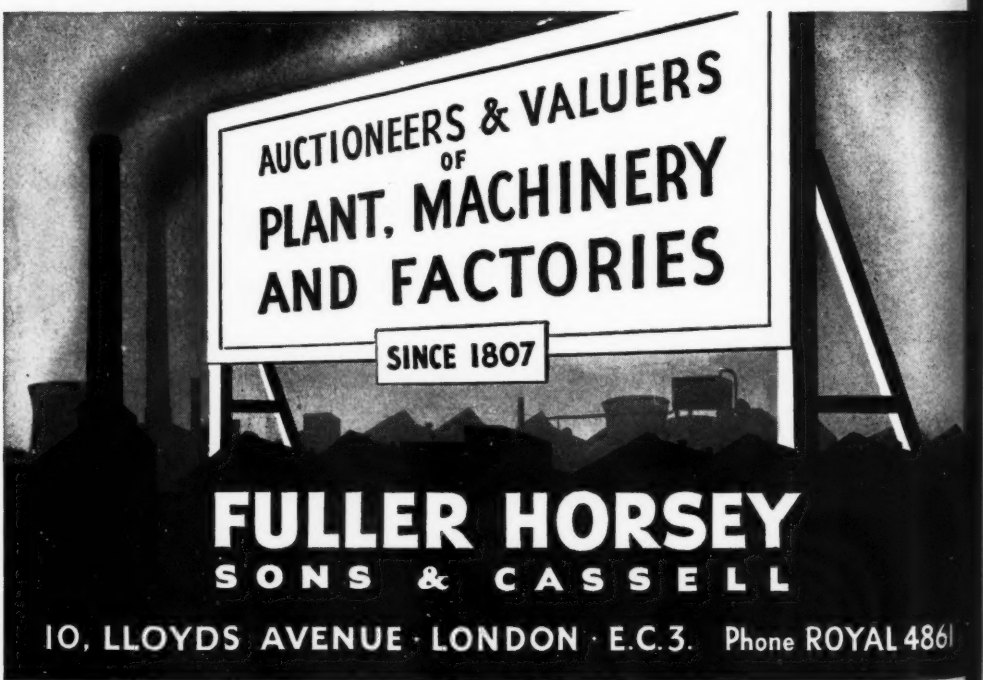
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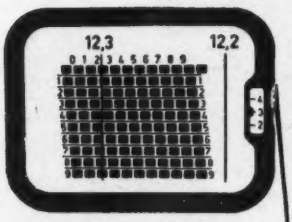
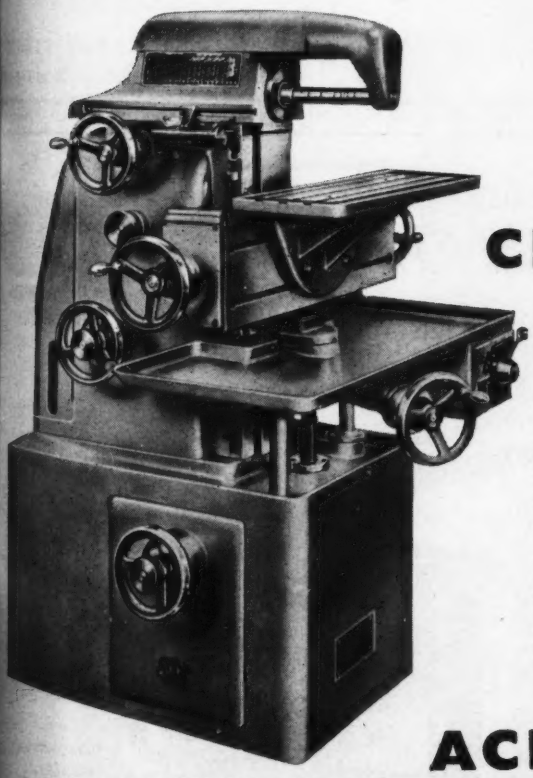


Two scales as shown controlling longitudinal and transverse settings



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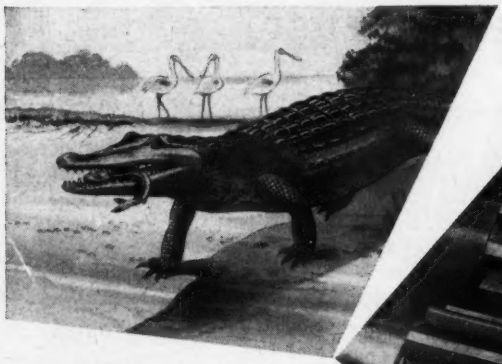

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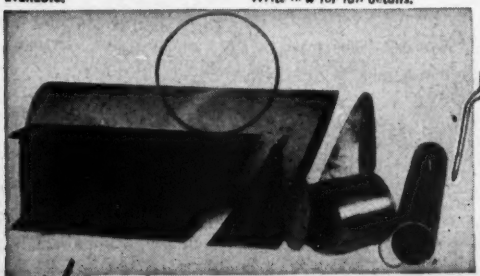

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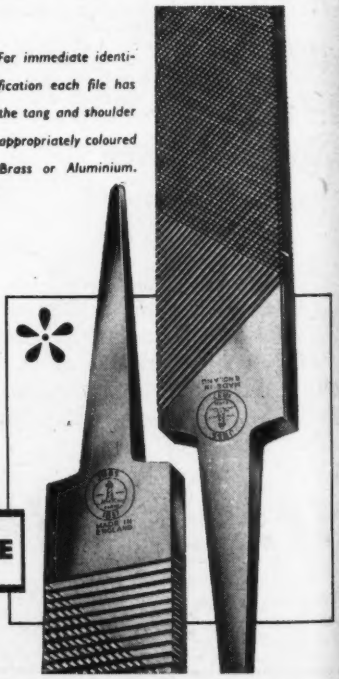

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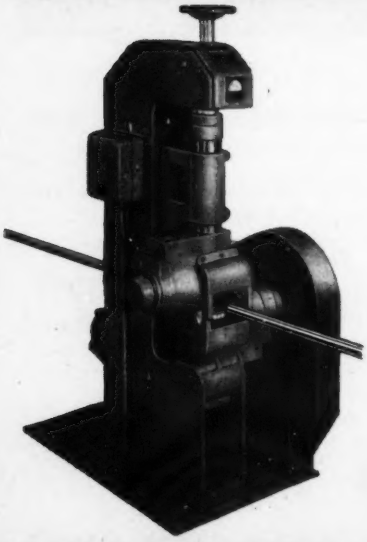

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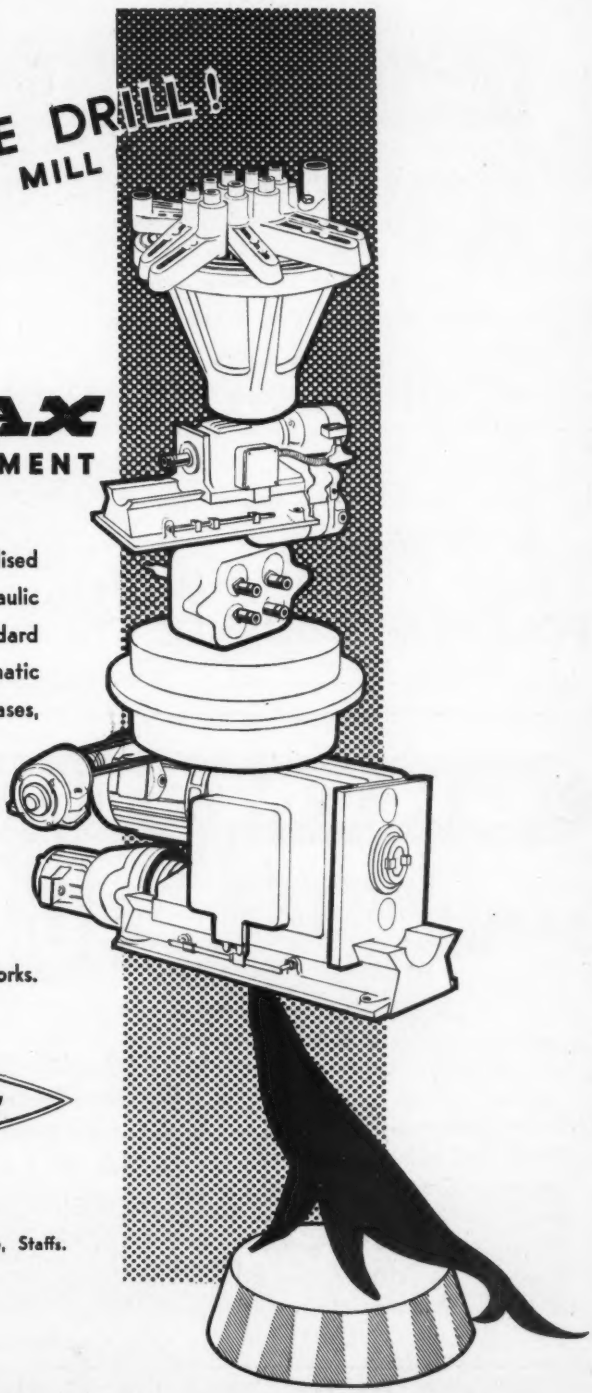

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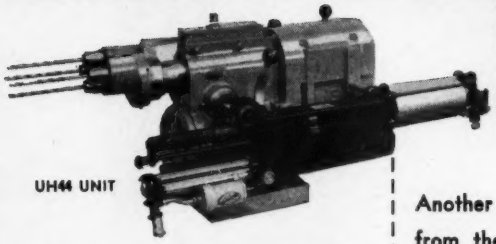

UH44 UNIT

Above is shown Unit Head type UH44, fitted, in this example, with automatic hydraulic / pneumatic feed control and provided with four spindle speeds. The multi-spindle drilling attachment was designed to suit special requirements.

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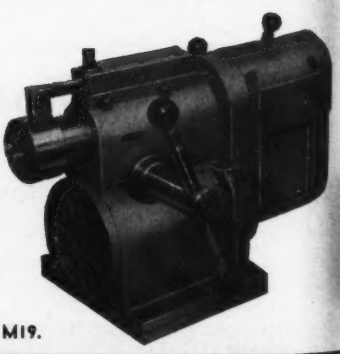

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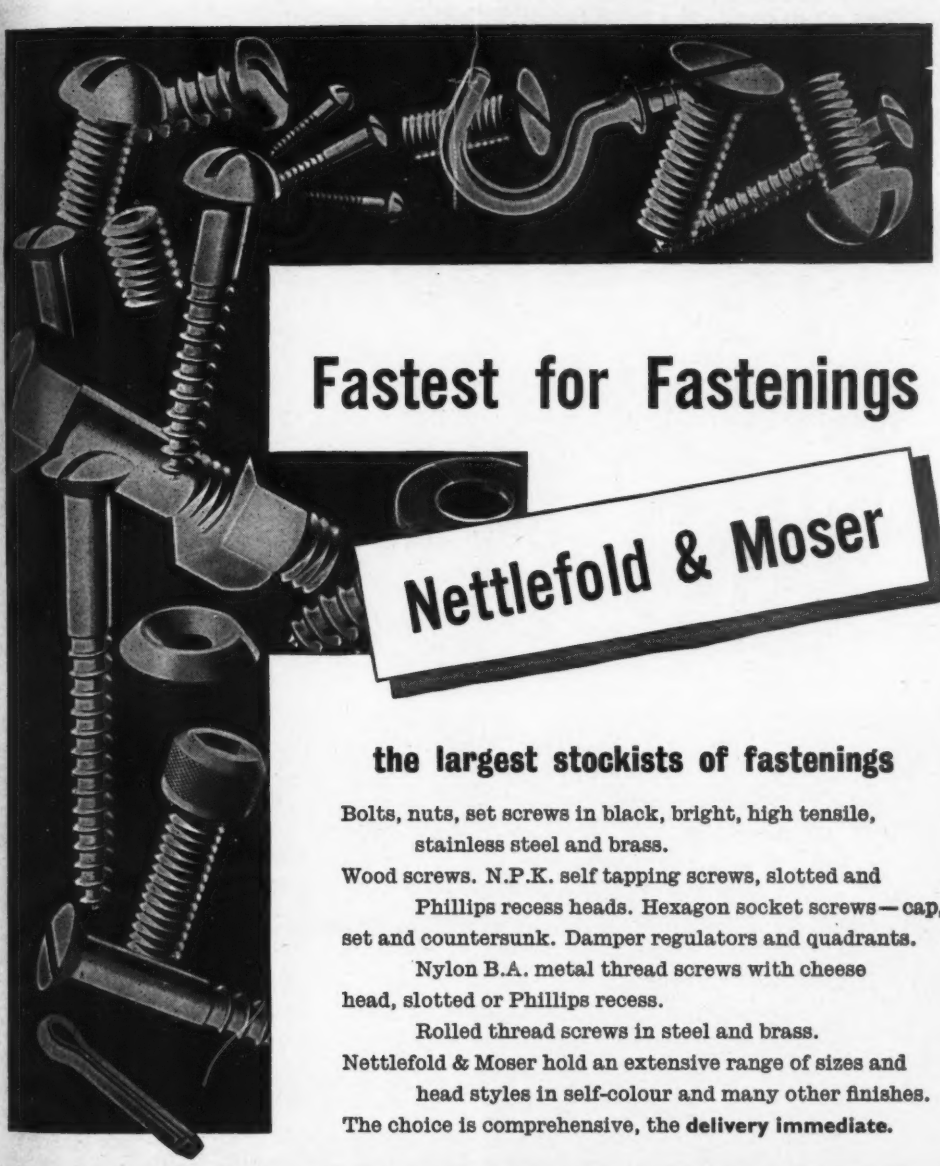

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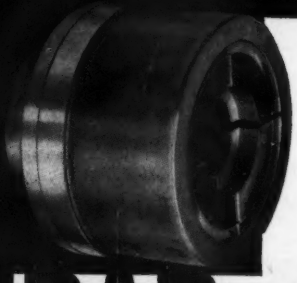

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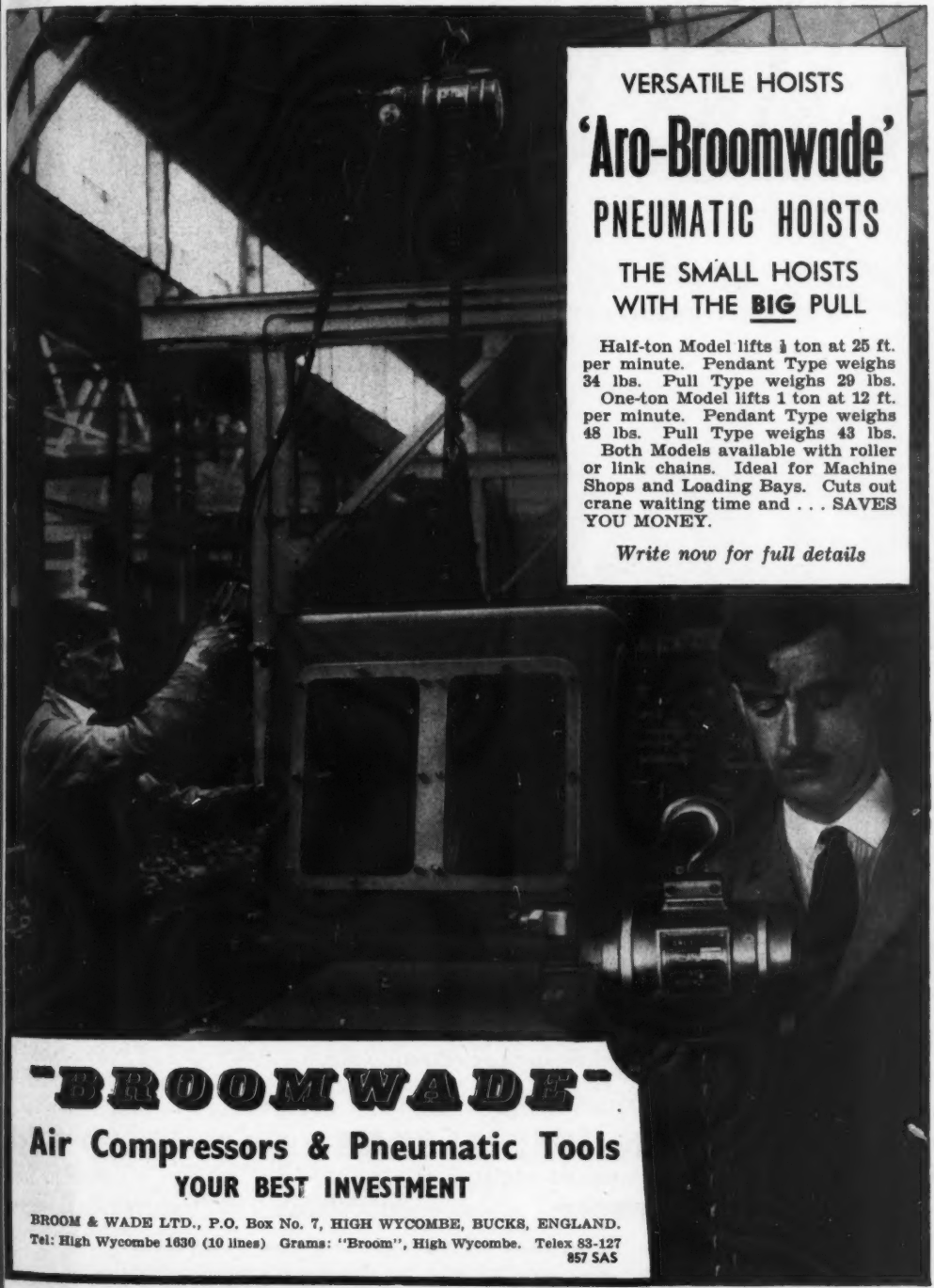

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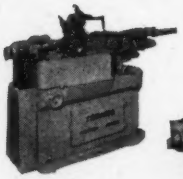

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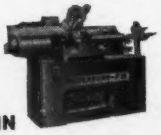

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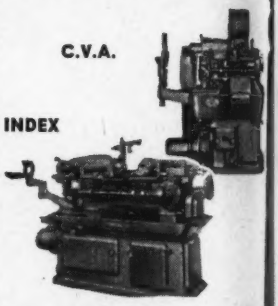

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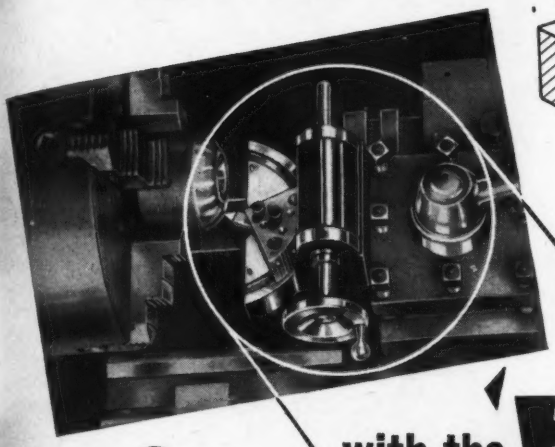
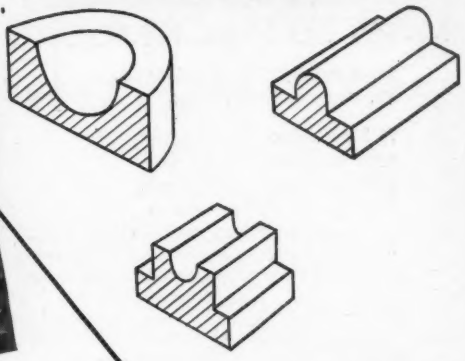
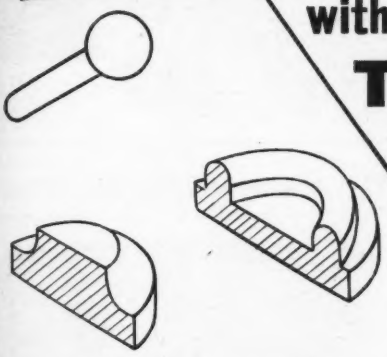
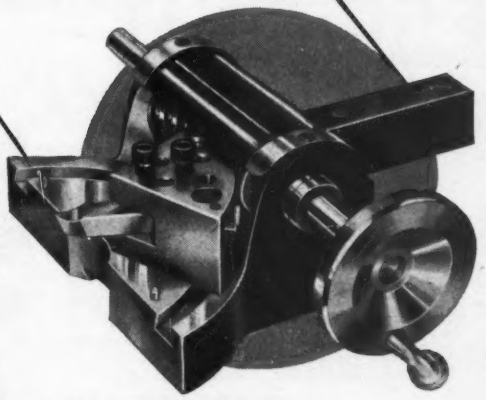




with the 'HABIT' TURN-A-ROUND

SPHERICAL TURNING ATTACHMENT





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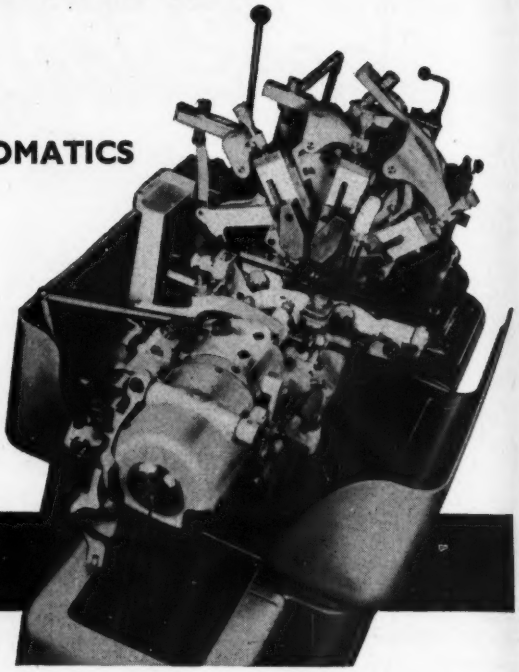

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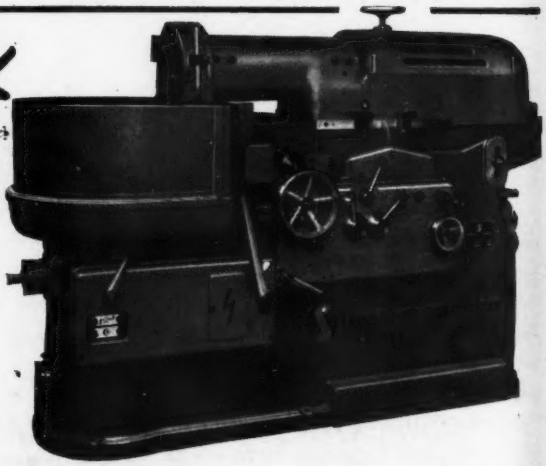

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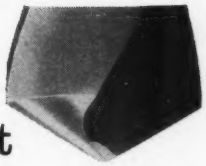

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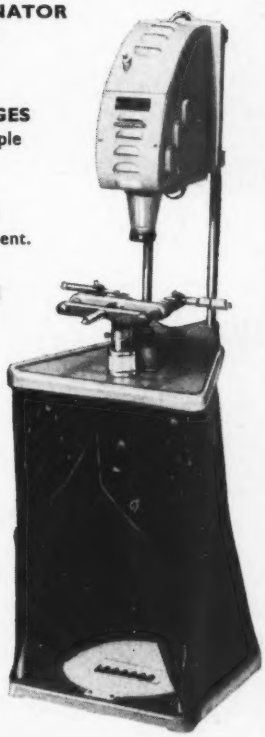

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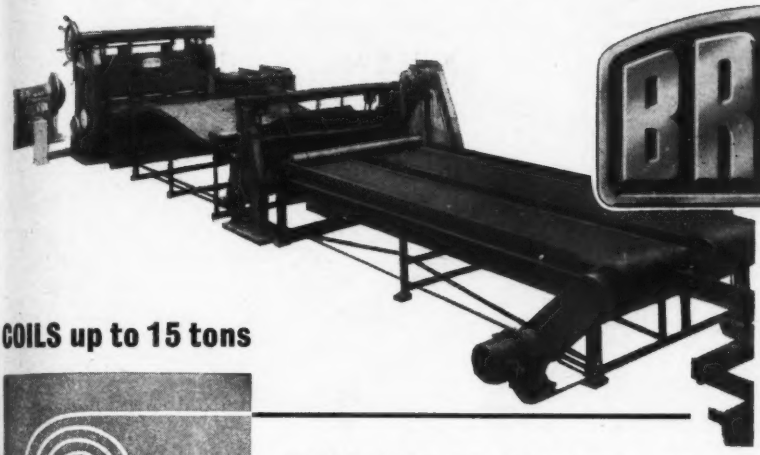

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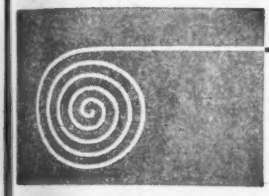

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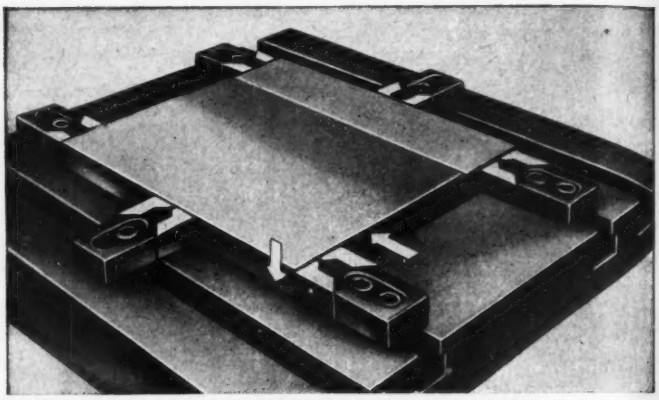

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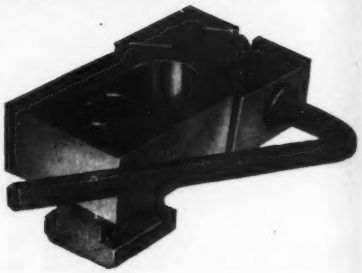
2	60/1 3 5 3	60/2 3 11 0	3⅞	2	1	⅝	2
3	61/1 4 14 6	61/2 5 2 0	5¼	3½	1 7/16	¾	3½



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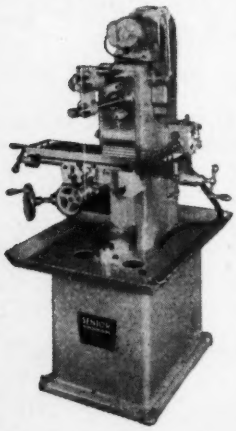

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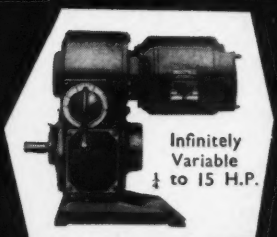

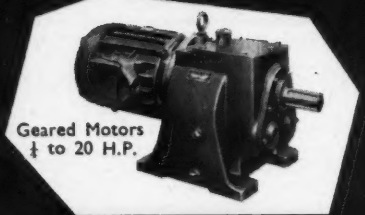

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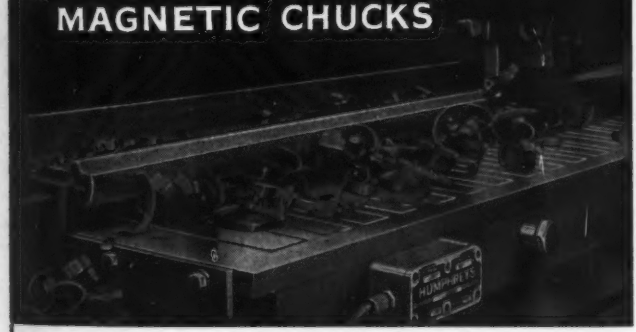

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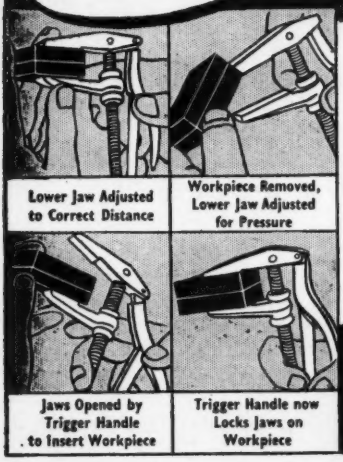

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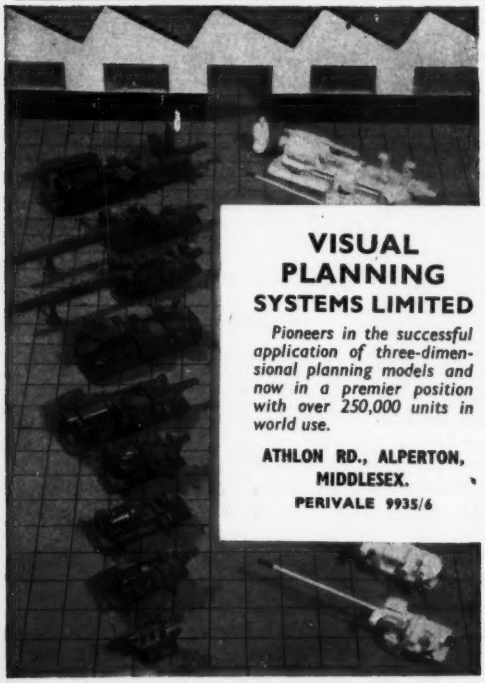

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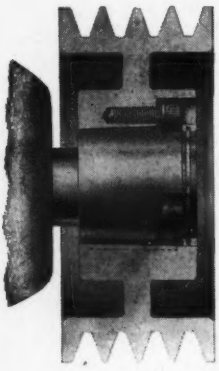

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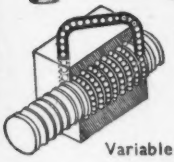

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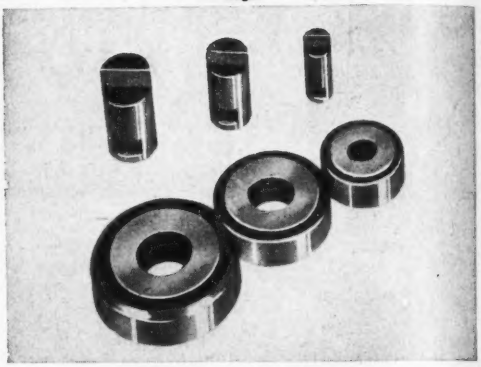

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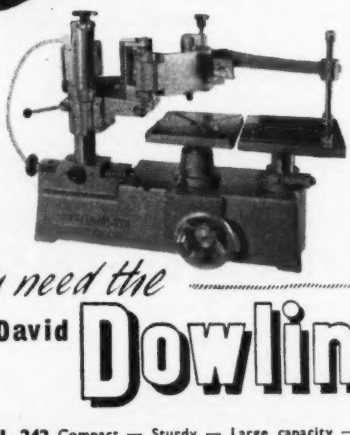

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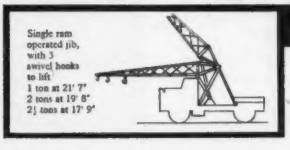

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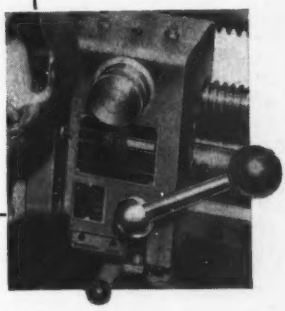

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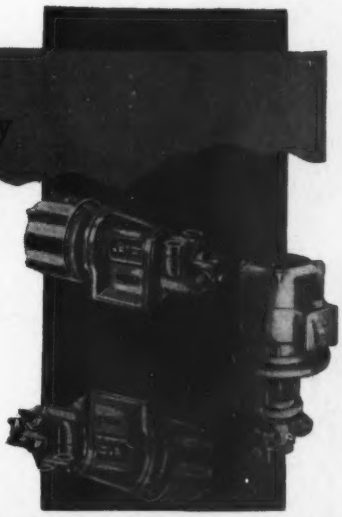

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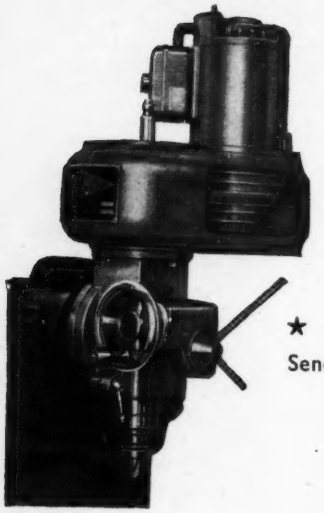

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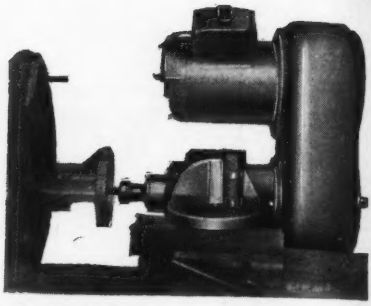

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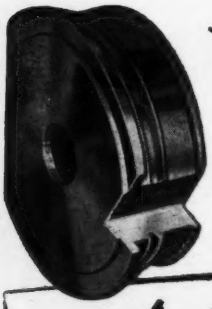

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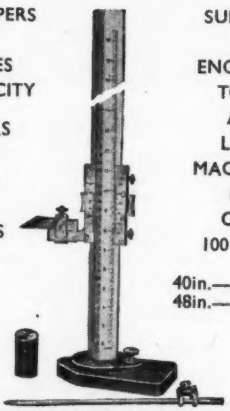

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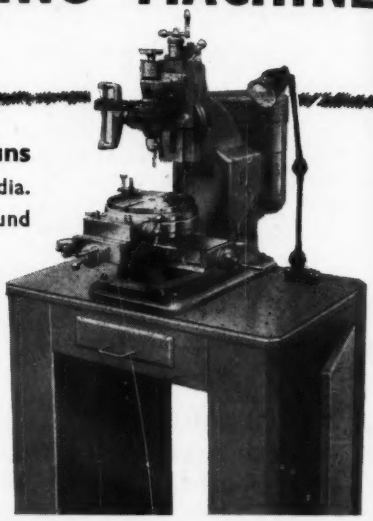

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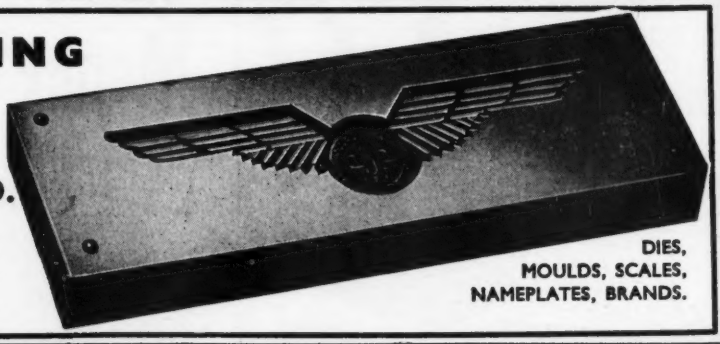

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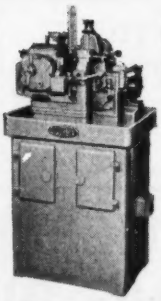

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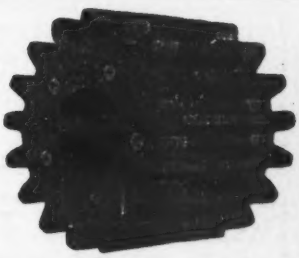

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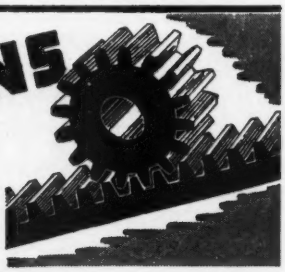
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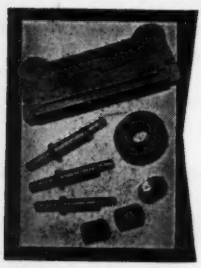
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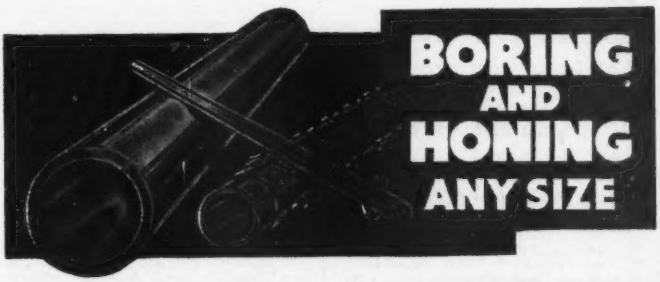

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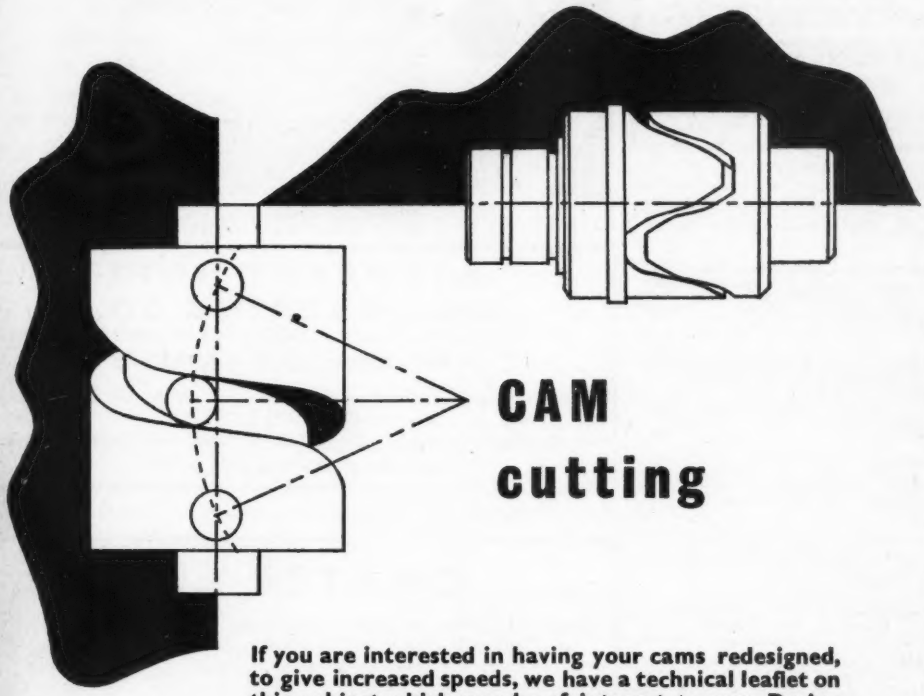

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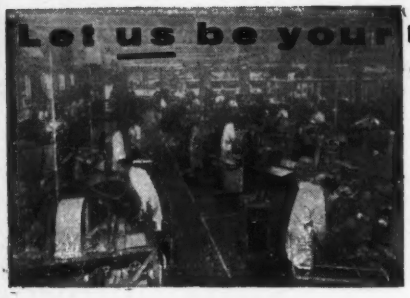

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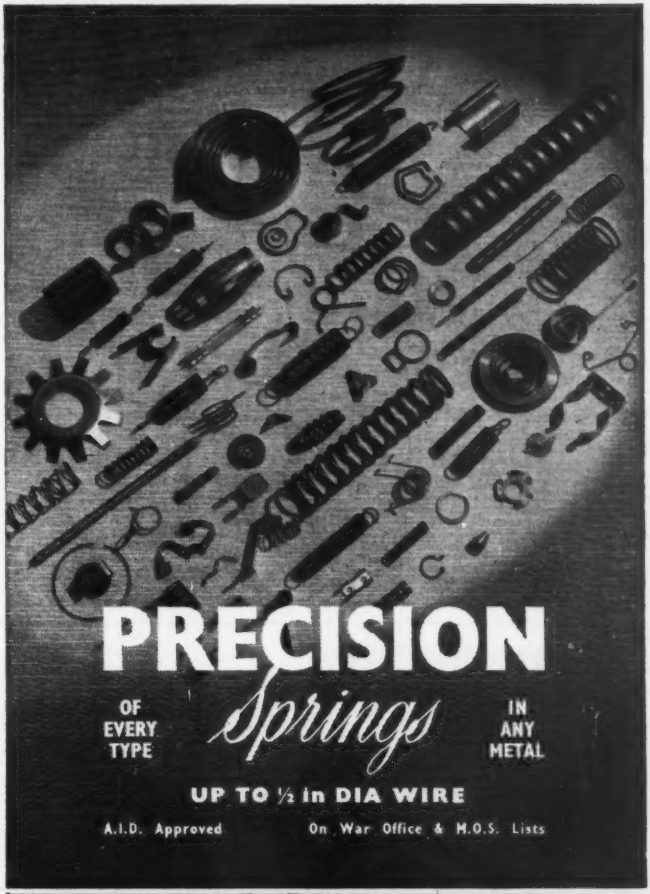

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ANNOUNCEMENTS

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Classified Advertisements (*ANNOUNCEMENTS, contd.*)

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must have table at least 72in. by 22in. approx., and taking 36in. between heads or more. Details of price, where seen to:

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Max. dia. 42in. Spurs, wormwheels with crossfeed head.
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SUPERALPHA 6in. by 40in. lathe.

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Table size:—
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JUNG 6in. × 18in. Surface Grinder.
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ARCHDALE 30in. Vertical Miller.
STAMCO 5ft. × ¼in. Deep Throat Guillotine.
PELS NIBBLER, ¼in. cap., 40in. throat.

IMMEDIATELY AVAILABLE

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VICTORIA U2 Rapidmil.
NORTON No. 3 Fly Press.
Q. & S. 6in. Saw.

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PEGARD Kneeless Type Vertical Miller, 36in. under spindle, table travel approx. 4ft.
BUFFALO 28U Double Ended Punch, Shear and Angle Cropper.
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ORCUTT 24in. Automatic Gear Grinder. New 1957.

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Swing over the table.....22in.
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Well equipped.

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REDMAN 12 × 4 × 4 Planer.
HERBERT 9S Turret Lathe.
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CHURCHILL PBH 12 × 36 Univ. Grinders.
All modern fully motorised machines.

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Richmond Horizontal Milling
Machine, Type O3. Table 38 ×9, 440 volts, vertical head, 195 lb.—NOTTINGHAM 271437.

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Machine. Capacity 10,000 lb. Tensile compression and bending.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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Hobbing Machine, motorised, complete with gears, in excellent condition. Price £215, ex-works.
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B.T.H. Induction Slip Ring
Motor, type FMT.
Enclosed Ventilation.
400 volts, 50 cycles, 3 phase.
Continuous rating 35 h.p., 49 amp. 965 r.p.m.
Available for inspection.
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Machine. Spindle dia. 5in. Table area 65in. × 19in., 7.5 h.p. Spindle nose 50 int. taper.—BOX C770, MACHINERY, Clifton House, Euston Road, N.W.1.

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Model 11NM M/d all-geared hollow spindle (3¼in.) S.S. & S.C. Lathe, with taper turning attachment, on 13ft. 3in. gap bed. Admits 8ft. 6in. b.c. and 38in. dia. in gap, 16 speeds 14-408 r.p.m. Norton type gearbox.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246

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Heated Furnace, 6ft. 10in. dia., 8ft. 10in. deep, 550 deg. C., 100 kW, 400 volts.
New Process 100 kVA Seam Welder, 400/3/50.
British Federal 50 kVA Flash Butt Welding Machine, 400/3/50.
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Colchester 7in. Centre Lathe, 7ft. gap bed.
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Pels Punch Shears and Cropper, 12in. blade, shear ½in., takes 6in. × 6in. × ½in. angles.
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20 Ton Morris Goliath, 35ft. span, 5 ton auxiliary.
10 Ton Heywood, 34ft. span. Unused.
10 Ton Morris, 32ft. 10in. span, cab control.
10 Ton, 60ft. span. 1955. (Two.)
7 Ton, 37ft. span. 1950. (Two.)
5 Ton, 37ft. span. 1944.
3 Ton Morris, 149ft. span. 1954.

FRED WATKINS (ENGINEERING), LTD., Coleford, Glos. 'Phone: Coleford 2271 (5 lines)

Broadbent 8½in. × 8ft. A.G.H.
S.S. & S.C. Lathe with taper turning, motorised 440/3/50, good condition. Below.
Precimax Cylindrical Grinder, 6 × 24, Model MPL. Hydraulic, motorised, 440/3/50, overhauled and in first class condition. Below.
Archdale 4-spindle Drilling and Tapping Machine, independent 4-speed motors and reverse, table 48in. × 16in., good condition.

ROEBUCK, Oldbury Road, Smethwick 0335.

LANG 15in. S.S. & S.C. Gap Bed Lathes. Speeds 7½ to 220 r.p.m. 2in. hollow spindle. 60in. between centres.
ORCUTT Internal Gear Grinding Machine, with indexing head. 15in. stroke of cutter head (New condition.)
B.S.A. No. 7 Centreless Grinding Machine. Width of wheels 4in., with ejector.
TAYLOR HOBSON Model CXL Engraving Machine, with cutter grinding attachment. Table 18in. × 15in.
CLIFTON & BAIRD 6in. capacity Cold Saw. Hydraulic feed. 18in. dia. saw.
TIMBRELL & WRIGHT Model 2A Capstan Lathes. Collet chuck. 1¼in. capacity.
PENSOTTI 14in. Precision Vertical Slotting Machine. Swivel head. 24in. Rotary table. Vernier calibrated.
TAYLOR & CHALLEN Model 370—20 tons open-fronted ungeared Power Press. 3in. stroke. Bed area 27in. × 23½in.

PARKES (MACHINE TOOLS) LTD.,
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Tel.: EASt 1742.

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DRILLING AND TAPPING

HERBERT 1-sp. Drill on three-spindle base. £165.
HAGO H.G.25 High Efficiency, ½in. cap. £250.

GRINDERS

REID No. 2 18 × 6 Surface.
BROWN & SHARPE No. 2 18 × 6 Surface.
JONES & SHIPMAN 540 Surface.
SCRIVENER No. 1 Centreless, with auto. feed.
SMART & BROWN Internal Grinder. 1½in. Max.
NORTON 18in. × 7in. Hyd. Cyl. Grinder. £395.

LATHES

MURAD 4in. × 24in. AGH Lathe. £125.
KERRY 5½in. × 24in. S.S. & S.C. Lathe.
WARD No. 7 Capstan B/F, B/C.
C.V.A. No. 8 Automatic.
COLCHESTER STUDENT 6in. × 24in. Full equip.
HARRISON 4½in. × 42in. G.B. Full equip.
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SPRINGFIELD 14in. Swing F. & B. Lathe. £225.

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ADCOCK & SHIPLEY 1VM Vert. 25in. × 7in. As new.
HARDINGE 24in. × 6in. Prec. Auto feed. £165.

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COHEN 10 ton Friction Screw Press.
E.M.G. 9-ton Airdraulic. £200.
KENNEDY 2in. Tube Bender. £85.
FLY and Kick Presses.

MISCELLANEOUS

THIEL Punch Shaper.
ORMEROD 12in. Shaper with Cam Cutting Attach.
TMA Engraver with type.
AEROGRAPH Twin Cylinder comp. 100 p.s.i.
MATHEY Jig Borer with clocks. As new.
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Snow Hydraulic Surface Grinder, Model P24. Capacity 24in. × 8in. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5.

FOR SALE

LEES-BRADNER Hobber Model 7HD. 8in. by 20in. Single Spindle.
LEES-BRADNER Hobber Model 7A. 8in. by 20in. Eight Spindle.
LEES-BRADNER Hobber Model 7HD. 8in. by 20in. Six Spindle.
LEES-BRADNER Hobber Model 7HD. 8in. by 20in. Four Spindle.
LEES-BRADNER Hobber Model 12HD. 12in. by 20in.
LEES-BRADNER Hobber Model R. Heavy Duty. 16in. by 12in.
LEES-BRADNER Thread Miller. 24in. swing by 144in. between Centres.
LEES-BRADNER Model H.H. Heavy Duty Spline Hobber. 16in. by 144in.

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JER

LATHES

WILLSON 7½in. × 3ft. 2in. Well equipped. £325.
WILLSON 7½in. × 3ft. 2in. Taper turning. £325.
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CHURCHILL REDMAN Gap Bed. Nearly New. £1,500.
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CAPITAL 7in. × 3ft. 6in. £145.
DEAN, SMITH & GRACE 8in. × 4ft. S.P.D. Very good secondhand. £195.

CAPSTANS AND TURRETS

GISHOLT 1L Combination Turret. £475.
HERBERT No. 3 Capstan, power feed to saddle. £425.
ACORNTOOLS ½in., Collets, bar feed. £55

MILLERS

BIERNATZKI H4 6ft. 1½in. × 18in. S.P.D. £350.
KEMPSMITH 2G Universal, 45in. × 10in. £475.
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EDGWICK Plain No. 2, 46in. × 11in. £375.
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GRINDERS

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SNOW P24 Hydraulic, 32in. × 8in. £450.
JONES & SHIPMAN Tool and Cutter, 8in. × 22in. £275.

MISCELLANEOUS

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WILKINSON 10in. Slotter, 4-step cone. £175.
BARBER & COLMAN No. 12 Gear Hobber. £185.

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BERRY 6½in. × 36in. Centre Lathe, 2in. hollow mandrel, 9 speeds, 10½in. 3-jaw chuck, 400/3/50. £225.
SWEENEY & BLOCKSIDGE Double Sided Press, 40 tons, adjustable stroke, 400/3/50. £195.
TAYLOR & CHALLEN Double Sided 20 Ton Press, 6in. fixed stroke, 400/3/50. £65.
CORONA 2-spindle Drilling Machine, No. 2 and 3 Morse tapers. £250.

PLEASE WRITE FOR LISTS

Lang 8½in. S.S. & S.C. Centre Lathe, taking 5ft. 0in. between centres. Complete with 2 speed motor giving 16 Spindle Speeds. Taper Turning Attachment. Excellent condition.

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C. & G. OLDFIELD, LTD.,
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VICTORIA WORKS, LONDON, N.W.10
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Bertram 12½in. × 10ft. S.S. & S.C. Centre Lathe, complete with top Taper Turning Attachment, full length of bed. Further details from:—

C. & G. OLDFIELD, LTD.
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K·E·N·T

MILLING AND HOBBING

Maximiller Vert. Mill, 76in. × 18in., 888 T/S. Power to spindle and rapid all ways. REBUILT.
Somua F.V.2C, 60in. × 14½in. Vert. As new.
Herbert 18V Vert., 57in. × 14in. With rotary table. £525
Becker Vertical, 54in. × 14in. £150
Sant Andrea U.F.O.3, 57in. × 14in. As new.
Archdale 24in. Manufacturing. £185
Adams No. 5 Spline and Thread Hobber. £425

PRESSES AND SHEET METAL MACHINERY

Edwards 6ft. × ½in. Rolls. New. £295
S. Platt 3in. × 14g. Tube Roller. £395
C.V.A. 10 Ton Dieing Press. Roll feed and scrap cutter fitted.
Kendall & Gent Duplex Screwing M/c. Tangential heads, 2½in. cap. £400

CAPSTAN LATHES

Ward 2A. Feed to saddle.
Gisholt No. 3 Capstan. £275
Brown & Sharpe No. 2. 1in. cap. £145
Herbert No. 9 Turret.
Smart & Brown ½in. cap. Capstan.

LATHES

Willson 8½in. × 4ft. 6in. S.S. & S.C. £495
Niles 40in. swing × 5ft. Heavy Duty. £995
Dean, Smith & Grace S.S. & S.C., 36in. swing, 12ft. 6in. between centres.
Ditto. Non-screwcutting.
Churchill-Redman 6½in. × 3ft. 6in. £325
Lang 6½in. × 3ft. £225
Dean, Smith & Grace 8½in. Surfacing and Boring.

MISCELLANEOUS

Acme Gridley 6-sp. Auto, ½in. cap.
Malden Bar-ending Machine.
Granor 26in. Heavy Duty Shaper. £575
Coventry Climax 1,500lb. Fork Lift Truck.
Cincinnati 12in. × 48in. Univ. Grinder. £750

Many other machines in stock.

All motorised 440/3/50.

K·E·N·T MACHINERY & ENGINEERING CO.
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Cashmores

Selection of Machine Tools from Stock

CENTRE LATHES

MITCHELL 7in. S.S. & S.C. All-Geared Head Gap Bed Lathe, to admit 3ft. 0in. between centres.
WILLSON 7¼in. S.S. & S.C. Lathe, to admit 3ft. 0in. between centres.
FAIRBAIRN 13in. S.S. & S.C. Lathe with two saddles, to admit 17ft. between centres.
LANG 8¼in. S.S. & S.C. Lathe, to admit 4ft. 0in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe, to admit 4ft. 6in. between centres.

BORING MACHINE

WEBSTER & BENNETT 48in. Vertical Boring Mill, table speeds 4-88 r.p.m.

DRILLING MACHINE

RICHMOND SR1 36in. Sensitive Radial Drilling Machine.

GRINDING MACHINES

JONES & SHIPMAN Fig. 540 Horizontal Spindle Surface Grinding Machine, hydraulic feed, 6in. × 18in. capacity.
One similar Machine with vertical spindle.
NORTON 6in. × 18in. Horizontal Spindle Surface Grinding Machine with hydraulic feed.
LUMSDEN Model 90LE Vertical Spindle Rotary Table Surface Grinding Machine, with 24in. diameter magnetic chuck.
NORTON 6in. × 30in. Hydraulic Plain Cylindrical Grinding Machine, maximum wheel diameter 20in.

MILLING MACHINES

VICTORIA M.2 Universal Milling Machine, 40in. × 10in. table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
GREENWOOD & BATLEY Plain Horizontal Milling Machine, working surface of table 20in. by 10in.
EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.
EDGWICK No. 2 Dial Type Vertical Milling Machine, 46in. × 11in. table.

PLANING MACHINE

SWIFT SUMMERSKILL 8ft. × 4ft. × 4ft. Planing Machine with 4 toolboxes, all electric Lancashire Drive.

POWER HAMMER

MASSEY 5 cwt. Pneumatic Side Type Power Hammer.

SLOTTING MACHINES

BUTLER 14in. stroke All Geared Slotting Machine with 39in. diameter rotary table.
DUTRANNOIT 24in. stroke Precision Slotting Machine with swivelling head, 39¼in. table.

SHAPING MACHINES

BUTLER 12in. Heavy Duty Shaping Machine with swivelling table.
BUTLER 18in. Heavy Duty Shaping Machine.

SHEARING MACHINE

New **KEETONA** 8ft. 0in. × ¼in. Undercrank Guillotine Shearing Machine.

STRAIGHTENING ROLLS

BRONX 8ft. 0in. × ¼in. Straightening Rolls, 5 roll type.

All the above machines are motorised 400-440/3/50 cycles.

JOHN CASHMORE LTD.
NEWPORT 1, MON.
Tel.: Newport 66941 (6 lines).

NEWALL USED MACHINE DIVISION

HAVE AVAILABLE FOR EARLY DELIVERY

One NEWALL 2436 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 0 Jig Borer, fully rebuilt and carrying maker's guarantees.

Capacity: 18in. by 12in. Table 14in. Spindle Nose to top of table

One NEWALL 'L1' Internal Grinding Machine, 10in. by 24in. fully rebuilt and carrying maker's guarantees. Maximum Grinding Depth: 12in.

One NEWALL No. 1 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 2 Jig Borer, fully rebuilt and carrying maker's guarantees.

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USED MACHINE DIVISION
OUNDLE ROAD
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Telephone: Peterborough 67116/7

Boneham & Turner Fine Borer with 4 spindles, 16in. × 9in. table with hydraulic tool relief, 20in. between heads, 4in. height of centres, 400/3/50, 2,850 r.p.m. Ex. cond.—BOX C773, MACHINERY, Clifton House, Euston Road, N.W.1.

10in. × 24in. Churchill Model PAH Hydraulic Universal Tool and Cutter Grinding Machine with rise and fall wheelhead. Fully m/d 400/3/50. Variable hydraulic motion 6in.-180in. per minute.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

American First Class Machines of all types can be supplied from our American Showrooms. Send your enquiries to K & C MACHINERY, LTD., Stephen Street, Coventry. Telephone: Coventry 23669.

F. J. Edwards Ltd

SAWING MACHINES

NEW **KALTENBACH** 14in. Blade Model KKS350 Universal Circular Sawing Machine to cut steel and non-ferrous metals any angle from 0 deg. to 180 deg. Send for particulars of this unusually versatile machine. Demonstration gladly arranged. SOLE BRITISH AGENTS.
TAYLOR No. 1142 high speed Circular Sawing Machine, capacity bar ¼in. dia., tubes 1¼in.
MIDSAW MINOR 16in. Toolroom Bandsawing Machine. (New.)
SPEEDAX 16in. Bandsawing Machine for metal, wood and plastics. (New.)
NEW **ARNOUX** Heavy Duty Combined Vertical and Horizontal Bandsaw, 8in. capacity.

SCREWING MACHINES

OSTER 6in. Screwing Machine. Cutting Off Attachment. Large quantity of dies.
WINN Hand Screwing Machine, ¼in.-1in. Whitworth.
MAIDEN 4in. Screwing Machine, bolts ¼in.-2in. (New.)
MAIDEN 2in. Screwing Machine, bolts ¼in.-1¼in (New.)

SHAPING MACHINES

ORMEROD 26in. Stroke Shaper, auto down feed.
INVICTA 6M Shaper, 24in. stroke.
ALBA 6S Shaping Machine, 24in. stroke.
NEW **MAJOR** 30in. Shaper. (New.)
BROOK 24in. Shaper. (New.)
GOULD & EBERHARDT 20in. Shaper.
BUTLER 12in. Shaper.
ALBA 14in. and 10in. Shapers.
INVICTA 30in. Shaper, swivel table. (New.)
BROOK 24in. Shaping Machine, swivel table and auto hold down feed. (New.)
NEW **ALBA, BROOK AND INVICTA** 18in. Shapers.
ORMEROD 12in. Spline Shaping Machine.
TORPEX 10in. Shaping Machine.
ORMEROD 26in. Stroke Traversing Head Shaper; one head, two tables (1953).

PLANING MACHINE

REDMAN 12ft. × 3ft. 6in. × 3ft. Planer, two toolboxes.

TAPPING MACHINES

JONES & SHIPMAN "Electrotap" Vertical Tapping Machine, leadscrew control with auto cycle for depth, reverse and stop, 1¼in. stroke, 200 r.p.m.

BORING MACHINES

NEW **SWEDISH** Precision Horizontal Boring Machines, 3in. and 3½in. travelling spindle; with facing head and screwcutting motion. (Sole British Agents.)
KEARNS OB Horizontal Borers, with screwcutting motion, covered bed, spindle 2¾in.
GIDDINGS & LEWIS No. 0 Horizontal Boring, Milling and Drilling Machine, 3¼in. traversing spindle, table 45½in. × 27½in.
RICHARDS P.R.T.2N. Horizontal Boring and Facing Machine, 3in. traversing spindle, 1955 machine, extra height and length.
RICHARDS HB2 Horizontal Boring, Milling, Drilling and Tapping Machine, 2¾in. spindle, screwcutting motion.
WEBSTER & BENNETT 36in. Vertical Borer.
FRORIEP 54in. Heavy Duty Vertical Turning and Boring Mills, with side head, all rapid traverses, table speeds 3½ to 180 r.p.m., main motor 50 h.p., 1952 machines in excellent condition. Weight 14½ tons.

CAPSTAN AND TURRET LATHES

WARNER & SWASEY 3A Turret Lathe, 4¼in. hollow spindle, 23¼in. dia. swing over bed covers.
HERBERT No 12 Combination Turret Lathe, roller bearing spindle, covered vee bed, swing over bed 23¼in., hollow spindle 6¼in. dia., good equipment, chasing saddle with automatic sliding and surfacing feeds.

359-361, EUSTON RD., LONDON, N.W.1
Telephone: EUSTON 5000. Telex: 24264.
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All Machines on Display in London

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NORTON MACHINE TOOLS

NORTON MACHINE TOOLS

AUTOMATICS

Single Spindle
8 B.S.A. 48 ¼in.
2 B.S.A. 68 ¼in.
1 BROWN & SHARPE OOG.
4 BROWN & SHARPE OG
3 BROWN & SHARPE 2G
3 C.V.A. No. 12 ¼in.
Multi Spindle
2 WICKMAN 5 sp. 1¼in.
4 WICKMAN 5 sp. 1¾in.
3 B.S.A. GRIDLEY 6 sp. 1in.
2 GRIDLEY 6 sp. 7/16in.
4 B.S.A. GRIDLEY 4 sp. ⅜in.
1 CONOMATIC 6 sp. 1¼in.
1 CONOMATIC 6 sp. 1½in.
1 GREENLEE 6 sp. 1⅝in.

BORERS

1 PEARN RICHARDS No. 3 Horizontal
1 RICHARDS No. 2 Horizontal
1 NEWALL No. 0 Jig Borer

CAPSTANS

1 HERBERT No. 1
1 WARD 1A
3 WARD 2A
1 WARD 2C
1 WARD 3A
9 WARD No. 7
3 WARD No. 7 Combs.
1 WARD 10B Comb.
1 LIBBY IH5 Turret

CENTRE LATHES

1 SWIFT 13in. by 132in.; 3.6 to 220 r.p.m.
1 SPRINGFIELD 12in. by 48in.; 9 to 380 r.p.m.
1 PROGRESSIVE 11in. by 120in.; 20 to 516 r.p.m.
1 CARDIFF 8¼in. by 48in. S.S. & S.C. Gap Bed; 20 to 970 r.p.m.
1 WILSON MK. V 7¼in. by 48in. Gap bed. NEW
1 CHURCHILL REDMAN 14in. by 20in. Hyd. Copying. Built 1957

PRESSES

1 TAYLOR & CHALLEN Model B3½, 60 ton
2 TAYLOR & CHALLEN 20 ton
2 TAYLOR & CHALLEN 15 ton
1 TAYLOR & CHALLEN B2 10 ton
2 TAYLOR & CHALLEN 6 ton
1 SCHULER 15 ton

DRILLING MACHINES

Radials
1 KITCHEN & WADE 4ft. 6in. Elevating arm, Box Table
Single Spindle
10 POLLARD CORONA, High Speed
Two Spindle
1 ARCHDALE
1 HERBERT
4 POLLARD CORONA, High Speed
Three Spindle
3 POLLARD CORONA
Four Spindle
5 POLLARD CORONA

GEAR MACHINERY

1 GLEASON No. 24 Straight Bevel Generator S/N17920
1 GLEASON 12in. Single Roll Roughing and Finishing S/N 19744
1 SYKES Type V.10A Gear Generator. UNUSED

GRINDERS

1 CHURCHILL 12in. by 50in. Hyd: Universal, internal spindle
1 CHURCHILL Centreless No. 2
1 MYFORD 5in. by 12in. MG 12 Cylindrical. NEW
1 MYFORD 5in. by 9in. MG9 Cylindrical
1 SNOW 72in. by 15in. VB 18 Vert. Spindle Surface
1 CHURCHILL 42in. swing 120in. bore Internal
1 HEALD Internal Model 81
1 BOYER SCHULTZ Profile. UNUSED

SHAPERS

1 BROOK 18in.
1 NEWEY 14in.

MILLING MACHINES

Universal
1 VICTORIA U.3, table 60in. by 12½in.; 22 to 1,020 r.p.m. NEW
1 ROSENFORS No. 2 table 51in. by 11in.; 28 to 1,500 r.p.m. Universal Dividing Head, Universal Vertical Attachment. Rotary Table
1 VICTORIA M2, table 45ft. by 11in. 30 to 1,010 r.p.m.
Plain Horizontal
1 VAN NORMAN No. 3 table 64in. by 14in.; 25 to 1,250 r.p.m.
1 MILWAUKEE 3H, table 64in. by 13¾in.; 20 to 1,000 r.p.m.
2 CINCINNATI 1/12 Production
2 ADCOCK & SHIPLEY Rack Feed Model 00
2 ADCOCK & SHIPLEY Rack Feed Model 0
1 ARCHDALE 20in.
1 BROWN & SHARPE
Vertical
1 CINCINNATI No. 3, Dial Type table 62½in. by 15½in.; 18 to 450 r.p.m.
1 CINCINNATI No. 2, Dial Type table 52in. by 12½in.; 20 to 500 r.p.m.
1 VICTORIA V.1, table 40in. by 11in.; 31 to 1,010 r.p.m.
1 CINCINNATI 08 Production
2 ADCOCK & SHIPLEY No. 1, table 37¼in. by 10in.; 15 to 1,500 r.p.m.

SLOTTERS

1 BUTLER 24in. Heavy Duty Production Type
1 BUTLER 12in. With Tilting Table
1 BUTLER 8in. Rebuilt

VARIOUS

1 MIDSAW Model D4 deep throat Bandsaw
1 TAYLOR TAYLOR & HOBSON 3, Dimensional Die Sinker
1 RAPIDOR Jig Sawing & Filing Machine, Tilting Table 15in. by 15in.
1 STEDALL Honer
1 ROEBUCK Riveter No. 2
1 WOLF DE Pedestal Grinder
1 HILMOR Bender
1 SCIAKY Flash Butt Welder
4 DENBIGH Nos. 2 and 4 Fly Presses

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BRONX 40, 60 and 90 ton Press Brakes
HEINEMAN 20in., 24in., 28in. and 34in. heavy duty High Speed Shapers also with copying units
COLCHESTER TRIUMPH Lathes, 7¼in. by 48in.

We pay generous prices for NEARLY NEW medium and heavy duty Machine Tools

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Classified Advertisements (PLANT FOR SALE, contd.)

MIDLAND

AUTOMATICS

BULLARD "Mult-Au-Matic" 8 spindle-11in. swing.

BORING MACHINES

WEBSTER & BENNETT 24in. swing "Duplex" Vertical Borer.

BANDSAWS

THIEL No. 17 Metal Bandsaw.

CROPPING MACHINES

Angle Cropping Machine. Cap. up to 6in × ⅜in. angles.

DRILLING MACHINES

POLLARD 13in. Pillar Drill. No. 2 Morse Taper. R. & F. Table 11in. × 11in.

TOWN 6ft. Radial Drill. Box table.

GRINDING MACHINES

ELB 24in. × 8in. Hydraulic Surface Grinder Non-electric mag. chuck.

New **NORTON** 10in., 12in., 14in., 16in. and 20in. D/E. Tool Grinders.

CAPSTAN AND CENTRE LATHES

HERBERT 9 Combination Turret Lathe.

HENDEY 9in. S.S. & S.C. Lathe. 12 speeds 14 to 478 r.p.m. Taper turning 4ft. 6in. between centres.

LANG 10½in. × 5ft. S.S. & S.C. Gap Bed Lathe.

BERRY 12½in. × 7ft. 6in. S.S. & S.C. Gap Bed Lathe.

HAMMERS

MASSEY 5 cwt. Slide Type Pneumatic Hammer. 400/3/50.

MILLING MACHINES

RICHMOND H.2 Horiz. Miller. Table 35in × 9in.

PRESSES

BRADLEY & TURTON No. 3 Flypress.

SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SCREWING MACHINES

KENDALL & GENT 3in. Screwing Machine Leadscrew Type.

SHAPING MACHINES

WOTAN 27in. stroke Hydraulic Shaper.

POLISHING MACHINES

3 and 5 h.p. Polishing Spindles.

All machines 400/3/50 electrics unless otherwise stated

THE MIDLAND MACHINE TOOL CO.

BRADLEY, BILSTON, STAFFS

Tel.: Bilston 42471/9

DIMCO

Two **JONES & SHIPMAN** Model 540 Hydraulic Surface Grinders. Table size 6in. × 18in. Automatic and hand longitudinal traverse 19in. Table speeds 5-40ft. per min. 3 years old. Motorised 400/3/50.

No. 2 **WARNER & SWASEY** Chucking Capstan.

No. 3 **GISHOLT** Chucking Capstan, some bar feed equipment.

2S. **HERBERT** Bar Feed Capstan Lathe.

2SS. **HERBERT** Bar Feed Capstan Lathe.

4ft. **ASQUITH** Universal Drill. Portable.

6ft. × ⅜in. **BENNIE** Guillotine. Heavy Duty.

8½in. **LANG** S.S. & S.C. Lathe, 4ft. between centres.

36in. × 10in. **FRITZ WERNER** Plain Miller.

New 7in. **WOODHOUSE & MITCHELL** Type 70 Junior Lathe.

60in. **JACKSON & BRADWELL** Balancing Machine.

20in. **ARCHDALE** Plain Milling Machine. Power feeds and rapids.

¼in. **HERBERT** Pedestal Drill.

6in. **HOLBROOK** Toolroom Lathe.

14in. **BUTLER** Slotting Machine. Circular table.

8½in. **FABIUS** Lathe, 5ft. between centres. (New.)

Model HBY **CHURCHILL** Internal Grinder.

No. 3 **KITCHEN & WADE** Vertical Honer.

No. 2 **DRUMMOND** Maxicut Gear Cutter.

27in. **WOTAN** Hydraulic Shaper.

16in. **BLANCHARD** Rotary Surface Grinder.

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New 35½in. **ZERBST** Lathe, 10ft. 4in. between centres.

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No. 2 **WARNER & SWASEY** Chucking Capstan.

24in. × 8in. **ABRASIVE** Model 3B Surface Grinder, with magnetic chuck. As new.

New **LAGUN** 49in. × 12in. Universal Miller, with dividing heads and universal attachment. Power feeds and rapids in all directions. £1,250.

DIMCO (Gt. Britain) LTD.

28, Wood Lane, SHEPHERD'S BUSH, LONDON, W.12.

SHEpherd's Bush 4401/2.

No. 26 Sunderland Automatic Double Helical Gear Planer. Cap. 52in. dia., 10in. face, 2 D.P. 30 deg. helix angle. 7½ h.p. 440/3/50 a.c. motor drive.

No. 23 Sunderland ditto. Cap. 24in. dia. 4in. face. 4 D.P. 30 deg. helix angle. 3 h.p. 440/3/50 a.c. motor drive.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

Kearns No. 2 Horizontal Boring and Facing Machine, complete with Rear Stay. A.C. Motor.

Further details from:—

C. & G. OLDFIELD, LTD., 15, Abercorn Street, PAISLEY.

Rhodes Type F8 Open Fronted Double Crank Horning Press for sale. Designed for closing the two sides of large size sheet metal perambulators to the body. Pressure exerted about 40 tons. Centre to back 11¼in. Steel plate body. Motorised for 415/3/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

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No. 61A Fellows M/d Automatic Gear Shaping Machine to cut spur gears up to 18in. dia. × 5in. face external, 3in. dia. internal, 3-4 D.P.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

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DRILLING MACHINES

PROGRESS 3E 1¼in. Pillar Drill (April).
PROGRESS 4-Spindle Drill (April).
ARBOGA ER1830 Radial Drill (March).
RICHMOND HB3/12 4ft. 6in. Arm Radial (April).

GRINDING MACHINES

GHIRANGELLI A50 Centreless Grinder (June).
MYFORD MG12 Cylindrical Grinder (April).
BURDETT No. 70 18in. × 6in. Surface Grinder (June).
ABWOOD SGIA 18in.×6in. Surface Grinder. (April).

LATHES

BOXFORD AUD 4¼in. S.S. & S.C. Lathe (June).
COLCHESTER Chipmaster 5in. Lathe (November).
COLCHESTER Student 6in. Lathe (July).
COLCHESTER Triumph 7½in. Lathe (May).
CROWTHORN 7¼in. Lathe (August).
HARRISON 6½in. Lathe (April).
KERRY AG2 5½in. Lathe (July).
MYFORD Super 7B 3½in. Lathe (March).
WILLSON 6½in. Bed Capstan Lathe (April).
WILLSON 7½in. Newel Lathe (April).
WILLSON 7½in. Newel Mk. V Lathe (April).
WOODHOUSE & MITCHELL 7in. 70 Junior Lathe (July).

MILLING MACHINES

ABENE VHF3 Combined Horizontal and Vertical Mill (April).
ARBOGA EM825 Vertical Mill (June).
DENBIGH D4 Horizontal Mill (May).
SENIOR M1 Plain Mill (April).
VICTORIA UO Universal Mill (May).
VICTORIA U2 Universal Mill (July).
VICTORIA U2R Universal Rapidmil (May).
VICTORIA V3 Vertical Mill (April).
VICTORIA TV1 Turret Mill (April).
VICTORIA TV2 Turret Mill (April).
WOODHOUSE & MITCHELL Turret Mill 369 (July).
ZBROJOVKA FA3V Vertical Mill (April).

SAWING MACHINES

SPEEDAX 16in. Bandsaw (May).
SPEEDAX 20in. Bandsaw (May).
VELOX 10in. Hacksaw (March).
Q. & S. 6in. Cap. Hacksaw (March).
WICKSTEED 8in. Cap. Hydramatic Hacksaw (April).
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AUTOS.

MENURHIN Heading and Trimming Automatic.

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Horizontal

RICHARDS No. 2 PRTN 3in. dia. Travelling Spindle Horizontal Borer with facing Head.
GIDDINGS & LEWIS Model 45 Horizontal Boring, Milling Machine with 4½in. travelling spindle.
RYDER-WELLMAN 3½in. Horizontal Borer with travelling spindle.

Vertical

RICHARDS 72in. Double Column Vertical Boring and Turning Mill.

Cylinder

PADDON Mark III Type WP Cylinder Bo-boring Machine.

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EMTOC MINIATURE Jig Boring Machine. (New Machine under power in our showrooms.)
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CORONA Model 31HX Heavy Duty Multiple Production Cluster Drill.
CRAFTSMAN ½in. Bench Drills, 4 at £25 each.

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CRAVEN Heavy Duty Roll Grinder 40in. swing by 12ft. between centres. With automatic cambering and all-electric drive. (Machine of modern design.)
WALDRICH-SEIGEN Heavy duty roll grinder with cambering attachment.
PETEWE Model 3D Profile Grinding Machine. (Nearly new.)
WOLTERS Model IL Hydraulic Internal Lapping Machine.
DELAPENA Model HHM/IA Precision Honing Machine. (New.)
Two **LAMBERT** Model 73 Watchmakers Cutter Grinders. (Almost new.)
COVEL No. 2 Tool and Cutter Grinding Machine.
CINCINNATI No. 2 Tool and Cutter Grinding Machine.
SCRIVENER Model 2DF Centreless Grinder with hopper feed.
MATRIX No. 6 Internal Thread Grinders. 3in. by 10in.
HEALD No. 81 Sizematic Internal Grinder.
KAMENICEK Hydraulic Toolroom Universal Cylindrical and Internal Grinder 10in. by 20in.

MILLING MACHINES

Vertical

MILNES Vertical Miller.
ASQUITH Model 28V Vertical Milling Machine. Table 50in. by 15in.
FRITZ WERNER No. 3230 Precision Vertical Milling Machine. 24in. by 8in. table. Longitudinal and cross power feed table.
ROSSI Type VO Vertical Turret Mill.
VICTORIA Duplomatic Hydraulic Die Sinking Machine. (Almost New.)

Horizontal

MILWAUKEE Model 2 Horizontal Miller. (Dial type.)
BROWN & SHARPE Plain Horizontal Mill Table 60in. by 15in.
VICTORIA Model UI Universal Milling Machines of latest type in excellent condition.
ADCOCK & SHIPLEY Model I with auto cycle.
EDGWICK No. 1 Horizontal Milling Machine. 40in. by 10in. table.
Four **DENBIGH** Model No. C4 Horizontal Milling Machines.
VICTORIA Juniormil. (New.)
VICTORIA Junior Omnimil. (New.)
SANT ANDREA Model UFO15 Heavy Duty Horizontal Miller. 78½in. by 16in. table. Table travel 47in.
SANT ANDREA Model UFO15 Extra Heavy Duty Horizontal Miller 86½in. by 19in. table travel 67in.
Two **ARCHDALE** 18in. Automatic Cycle Kneeless Production Millers.

HOBBING

MIKRON No. 79 Gear Hobber. (Almost New.)
Two **SAFAG** Model 24 Cutter Relieving m/c's. (Almost New.)

LATHES

BOXFORD Model C Lathe on stand.
New **SMART & BROWN** Model 1024 Precision Toolroom Lathe.
SMART & BROWN Model M 4in. Precision Tool Lathe.
Two **COLCHESTER** 6½in. Centre Lathes.

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LE BLOND REGAL 19in. swing Centre Lathe.
CROWTHORN 10½in. by 5ft. 6in. centre height.
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DEAN SMITH & GRACE Heavy Duty 12in. Centre Lathe.

CAPSTAN LATHES

HERBERT No. 2 Pre Optive bar turret lathe. Flamard bed 2in. bar capacity with bar feed and fully turret tooled.
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WARD Model 3A Capstan (modern machine with oversize spindle).
MURAD Model 3Q ¾in. Capstan Lathe.
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SHAPING MACHINES

BERRY 16in. Shaper.
BROOK 18in. Shaping Machine.
ALBA Model 4S 18in. Shaping Machines.
KLOPP 22in. Shaping Machine.
TORPEX 22in. Shaping Machine.
ALBA 6S 24in. Shaper.
ORMEROD 32in. Heavy Duty Shaper.

SLOTTERS

DENHAM 6in. Slotting Machine.

SAWS

WADKIN Type MO cutting off saw.
E. H. JONES No. 7 Bandsawing machine.

POWER PRESSES AND SHEET METAL

ESSA Type ITL 1000 kg. High Speed Precision Double sided Press.
ESSA Type PL 6000 kg. High Speed Precision Double sided Press. (Five machines.)
BLISS Model 20B, 27-ton inclinable Power Press.
RHODES 3 ton open fronted Bench press with flange motor and UDAL guards.
HME Model DCP 3, 70 Ton double-sided, double-crank single action Power Press.
Three New **MULLER** Model AMP 22-ton Power Presses.
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Three New **MULLER** AMP 35-ton Power Presses.
Two New **MULLER** AMP 45-ton Power Presses.
Two New **MULLER** AMP 60-ton Power Presses Open Fronted.
Two New **MULLER** AMP 80-ton ungeared.
Two New **MULLER** AMP R 80-ton geared Powered Presses.
One New **MULLER** AMP 100-ton Power Press.
WEYBRIDGE Gang Slitter, 36in. by 20 s.w.g.
HANDS 4ft. by ¼in. Guillotine.
RHODES 6ft. by ¼in. Guillotine.

PLANING MACHINES

STIRK open sided HILO Planing Machine with Capacity 16ft. by 9ft. wide by 10ft. under crossrail. Table 16ft. by 7ft. Two toolboxes on crossrail and side toolbox. Aditional toolbox on auxiliary upright. Motorises by STIRK split field drive of 400 volts 3 phase 50 cycle A.C. Supply.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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can recommend the following modern quality machines from STOCK

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BULLARD 8in. Mult-au-Matic, 6 spindles type D.

RYDER Verticalauto, capacity 16in. swing × 8in., 6 spindles

BORING MACHINES

WEBSTER & BENNET 36in. Vertical Borer.

RICHARDS 36in. Vertical Boring Mill complete with side head.

JONES 6in. Spindle Horizontal Borer. Table 17ft. 6in. × 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons.

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SCHIESS Vertical Boring Mill, 39in. dia. of table. Maximum swing 48in. S.C.M.D. 35 h.p., 400/3/50.

GRINDING MACHINES

HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

BILLETER Hydraulic Open-side Slideway Grinding Machine, capacity 47in. × 12in.

LATHES

NOBLE & LUND Heavy Duty Centre Lathe, 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.

HARVEY Heavy Duty Centre Lathe, 42½in. centre height × 52ft. between centres. Max. swing over saddles 65in. dia.

CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 65ft. between centres.

CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 31ft. 6in. between centres.

HERBERT No. 11 Combination Turret Lathe.

MILLING MACHINES

ARCHDALE 30in. Vertical Milling Machine.

COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80, capacity 60in. × 30in.

PLANING MACHINES

CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.

CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

MISCELLANEOUS MACHINES

CLIFTON & BAIRD Horizontal Cold Sawing Machine, 30in. dia. Saw. Maximum capacity 22in. × 7in. R.S.J.

BUTLER 18in. Stroke Slotting Machine. Hydraulic Vertical Internal Honing Machine (manufactured by **PETER WOLTERS**), Capacity 0.2in. to 2in.

RAPIDAN Double Helical Gear Generating Machine, 12in. diameter capacity.

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'Phone:
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Kitchen & Wade H.4 Horizontal Drilling and Tapping Machine. Travelling Column Type with Square Indexing Table on Traversing Base.—Further details from:—

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REED PRENTICE LATHE

24in. swing. Admits 9ft. 6in. Straight Bed. Quick Change Gearbox. 7 HP Motor 415/3/50.

Can be inspected at Barnstaple, Devon.

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Sharples Super Centrifuge Oil Purifier. Type M/4/P/IE. Motorised.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

Niagara No. 172 Motorised Universal Swaging, Wiring, Slitting, Flanging Machine, etc., for sale. Capacity swaging, 18 s.w.g.; slitting, 16 s.w.g. Depth of gap to frame 6½in. Clutch. Circling attachment to handle from 4in. to 20in. diameter. Arranged motor drive 230-250/1/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

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OPEN-SIDED PLANING MACHINE

STIRK open-sided HILO Planing Machine with Capacity 16ft. × 9ft. wide × 10ft. under crossrail. Table 16ft. × 7ft. Two toolboxes on crossrail and side toolbox. Additional toolbox on auxiliary upright. Motorises by STIRK split field drive of 400 volts 3 phase 50 cycle A.C. supply.

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WILLSON 7½in. × 36in. Gap Bed S.S. & S.C.
LE BLOND 15RP S. & S. 15in. × 24in.
CARDIFF S.S. & S.C. 8½in. × 48in. "Senior." 1952 M/c.
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SMART & BROWN 4in. × 18in. S.S. & S.C.
SWIFT 12in. × 12ft. S.S. & S.C. Heavy Duty R/trav. to saddle.
LANG 36in. Surfacing and Boring.
ACME No. 5W Capstan, chuck machine.
RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor S.S. & S.C.
WILLSON 6½in. × 36in. Gap Bed S.S. & S.C.

CAPSTANS AND AUTOS

WARD No. 7 (Curran Sub-Contract).
TAYLOR No. 1263 Capstan, ¼in. cap.

DRILLS

GRIMSTON ELECTRISKA Model EB100 Bench.
CORONA Model 9FX Super High Speed Bench.
CORONA Model 12AX Bench, ⅝in. cap.
BRISDON Model 52 Pillar, ¾in. cap.

GRINDERS

KEIGHLEY KN Internal.
GRAND RAPIDS No. 35 Hyd. Hor. Spin. Surface.
HERBERT JUNIOR Surface, 10in. × 6in. × 9in.
BROWN & SHARPE No. 5 Surface.
BROWN & SHARPE No. 23 Plain, cap. 10in. × 48in.
BROWN & SHARPE No. 2 Surface, cap. 6in. × 18in.
SMART & BROWN Internal, 1½in. cap.
BROWN & SHARPE No. 5, 3in. × 18in. Plain.
BALLINGER 10/24 "Versatile" Abrasive Cutting-off Machine.
TURNER T.T. 14/20 d/ended Tool.
NEWALL Model L.U. 10in. × 36in. Hyd. Universal.
B.S.A. LANDIS Type C 6in. × 18in. Hyd. Plain.
SNOW Mod. O.S.72 Surface, cap. 15in. × 72in.
CHURCHILL Mod. H.C.B. Internal Auto Size.
HAHN & KOLB Hyd. Disc Lapping M/c.
JACKMAN No. 22 Disc, 18in. dia.
LUMSDEN Mod. 12M Tool, 14in. × 2 wheel.

MILLERS—Vertical

REED PRENTICE Mod. 3VG, table 38in. × 10in.
DENBIGH No. C4. Swivel table 46in. × 10in.
CINCINNATI Model O8 Production.
KENDALL & GENT Duplex Profile, table 18in. × 15in.

MILLERS—Horizontal

BROWN & SHARPE No. 000 Plain Auto Miller.
CENTEC No. 2A with vert. attachment.
BROWN & SHARPE No. 2 Universal, light type.
ADCOCK & SHIPLEY No. 1AB Plain, table 26in. × 7in.
RICHMOND 2HS Plain, table 35in. × 9in.
ARCHDALE 20in., table 40in. × 10in.
ASQUITH H.K.1 Duplex Keyway table 43in. × 10in.
CINCINNATI Mod. O.K. Prod., table 34in. × 12in.
ARCHDALE 14in. Plain, table 27in. × 8in.
ARCHDALE 28in. Plain, table 49in. × 13in.

BORING MACHINE

KEARNS Mod. O.C. Horizontal, 3in. dia. spindle.

SLOTTERS

RICHMOND 4in. Stroke (Unused). Two machines.

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TOWN 14in.
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MISCELLANEOUS

HEAP 2in. Screwing Machine.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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MASSEY 5 cwt. Clear Space Pneumatic Hammer.

ASQUITH 4ft. 9in. Portable Universal Radial Drill. No. 4 M.T. M.D. 400/3/50.

BLISS Model 21 Ungeared Inclinable Press. 30 tons cap. 3in. stroke.

CENTEC No. 3 Production Miller. Electronic control for automatic milling. Table size 22in. by 6in. hydraulic. M.D. 400/3/50.

ASQUITH Single Spindle Profile Miller. Table 17½in. by 15in. 8 speeds 25-3,000 r.p.m. Built 1954. M.D. 400/3/50.

PLANERS LTD. Double Sided Horizontal Planer. Table 8ft. by 2ft. 2in. Admits between sides 2ft. 6in. and under toolboxes 2ft. 6in. approx. Two toolboxes on cross beam. Rack and pinion drive to table. V-bed.

H. BELL (Machine Tools) LTD., Walter Street, LEEDS 4.

Edwards

NEW BESCO Motorised Plate Bending Roller. Capacity 6ft. × ½in. mild steel. Dia. of top roller 5½in., dia. of bottom rollers 4¼in. Top roller end housing is hinged and swings out to enable complete cylinders to be withdrawn. Arranged motor drive with push button controls for forward, reverse and stop motions. Suitable for 380-420/3/50.

36in. × ⅜in. Geared Plate Bending Roller, with steel plate frame, arranged motor drive 400/3/50. Top roller end caps are hinged to enable complete cylinders to be withdrawn.

PELS Type EFG20 Section Cropping Machine. Crops rounds 2½in., squares 2in., flats 5in. × 1¼in. or 6in. × ⅝in., angles and tees 6in. × 6in. × ⅝in. or on the mitre, 4in. × 4in. × ½in. Steel plate frame. Arranged motor drive 400/3/50.

SEDGWICK Motorised Press Brake. Capacity 6ft. × ⅛in. mild steel. Width between side frames 41in. Length of bed 76in. Side frames and base are of steel plate, other members cast iron. Depth of gap in frames, 15in. Die space, stroke down, bed adjustment in lowest position, 27½in. At present fitted with top toolholder 22in. deep and one set of vee forming tools. Back gauge. Arranged motor drive 440/3/50.

BESCO Type DG Motorised Nibbling Machine on cast-iron stand. Capacity ⅛in. mild steel. Depth of gap 33in. Circle cutting device to handle up to 48in. diameter. Detachable tie bars. Arranged motor drive 400-440/3/50.

CRAIG & DONALD Motorised Rotary Shearing Machine for cutting straight or irregular shapes in mild steel up to ⅛in. thick. Depth of gap 30in. Dia. of cutters 3¼in. Cutters are on inclined shafts. 2-speed motor suitable for 400-440/3/50.

RUSHWORTH Power Operated Double Geared Open Ended Guillotine Shearing Machine. Motorised for 380-440/3/50 supply. Capacity mild steel 4ft. × ¼in. With automatic sheet hold-down and adjustable front, back and side gauges. Weight approx. 50 cwt.

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Corona Heavy Duty Vertical

Drilling Machine. No. 5 Morse Taper Excellent condition.

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WILLSON Mk. V lathes.
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MYFORD Super 7 lathes.
DENBIGH D4 milling machines.
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PROGRESS 3A pillar drill.
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Taylor & Challen 4½ T.D.P.

Double Geared, Double Action, Deep Drawing Press. Single pulley drive.—BOX C641, MACHINERY, Clifton House, Euston Road, N.W.1.

One Secondhand Scrivener No. 1

Centreless Grinding Machine, maximum capacity 1¼in. diameter with Plunge Feed. Hand Operated. Motorised 400-440/3/50.

C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY

Kearns Model O.C. Horizontal

Boring Machine, 8in. dia. traversing spindle. 16 spindle speeds 18-725 r.p.m. Revolving table 42in. × 36in. Spindle to steady 7ft. 6in. Verniers. 7½ h.p. 400/3/50 motor.—LEE & HUNT LTD., Crocus Street, Nottingham. 'Phone 84246.

AUTOS

CONOMATIC 1¼in. 8 spindle. Type W.W.

BORING

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KEARNS No. 2 Horizontal Boring and Facing Machine, 3in. dia. travelling spindle (1953).
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WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PET Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.
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CAPSTAN AND CENTRE LATHES

OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
HERBERT No. 12 Combination Turret Lathe 6½in. diameter hollow spindle.
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U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30in. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.
TOWN 30in. Single Spindle Boring and Drilling Machine.

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GLEASON 8in. Straight Bevel Gear Generator.

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CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
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CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

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MISCELLANEOUS

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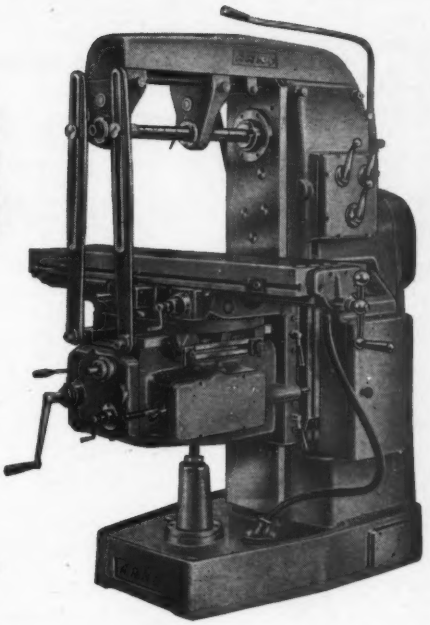

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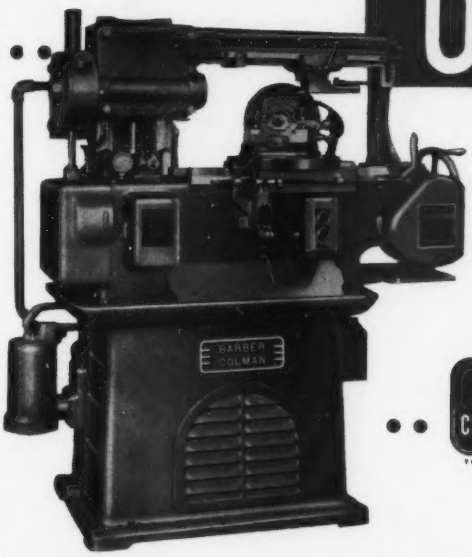

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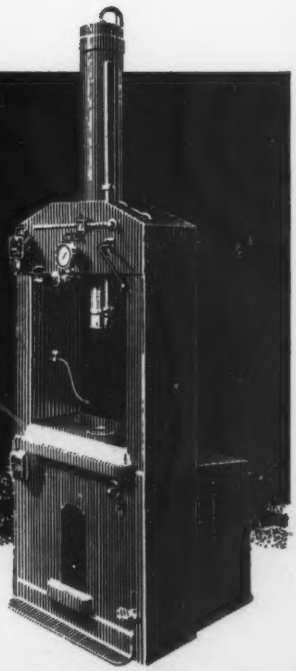

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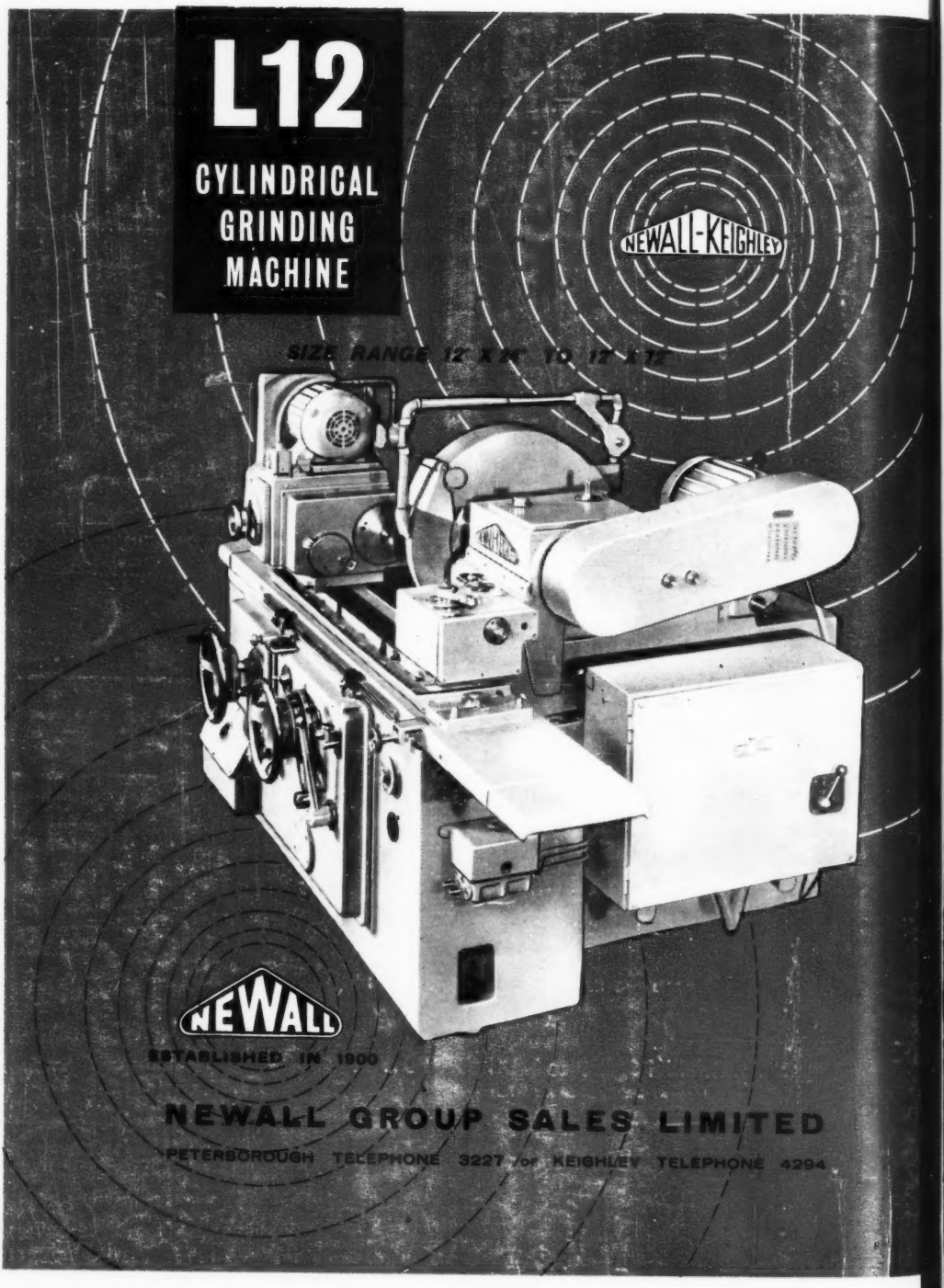

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